California High-Speed Rail Authority

RFP No.: HSR 14-32

Request for Proposal for Design-Build Services for Construction Package 4

Reference Material, Part E.3 – Final Archaeological Treatment Plan

CALIFORNIA HIGH-SPEED TRAIN

Section 106 Compliance Program

FINAL

Fresno to Bakersfield Section

Archaeological Treatment Plan

September 201

RFP No.: HSR 14-32 - INITIAL RELEASE 05/27/2015

CALIFORNIA High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

FINAL

Fresno to Bakersfield Section

Archaeological Treatment Plan

Prepared by:

California High-Speed Rail Authority

September 2014

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Key to Acronyms

A.D.	Anno Domini
ADRP	Archaeological Data Recovery Plan
ADRR	Archaeological Data Recovery Report
AER	Archaeological Evaluation Report
APE	Area of Potential Effects
AR	Authority Representative
ARMR	Archaeological Resource Management Report
ASR	Archaeological Survey Report
ATP	Archaeological Treatment Plan
Authority	California High-Speed Rail Authority
B.C.	Before Christ
B.P.	Before Present
cal B.C.	Calibrated Before Christ
cal A.D.	Calibrated Anno Domini
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CEU	Controlled Excavation Units
CFR	Code of Federal Regulations
CHRIS	California Historical Resources Information System
cm	Centimeter
CRHR	California Register of Historical Resources
CRCM	Cultural Resources Compliance Manager (for the Contractor)
DPR	Department of Parks and Recreation
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Environmentally Sensitive Area
FOE	Finding Of Effect
FR	Federal Register
FRA	Federal Railroad Administration
GPS	Global Positioning System
HST	High-Speed Train
ICS	Initial Construction Segment
MOA	Memorandum of Agreement
MLD	Most Likely Descendant(s)

NAHC	California Native American Heritage Commission
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966
NRHP	National Register of Historic Places
PA	Programmatic Agreement
PCM	Project Construction Manager
PI	Archaeology Principal Investigator (for the Contractor)
RE	Resident Engineer
SASR	Supplemental Archaeological Survey Report
SFOE	Supplemental Finding of Effect
SHPO	State Historic Preservation Officer
SR	State Route
STP	Shovel Test Pit
USGS	U.S. Geological Survey
UST	Underground Storage Tank
XPI	Extended Phase I

Definitions of Terms

Archaeological Data Recovery: Data Recovery excavations are conducted to collect data that makes archaeological sites legally significant.

Archaeological Feature: An area that reflects the presence of human activity or occupation. Archaeological features may consist of concentrations of artifacts. An archaeological feature may indicate the prior presence of a building or structure (e.g., wells, cisterns, and privies), foundation and cellar remains, and remains from fire hearths or storage pits.

Archaeological Monitoring Plan: An archaeological monitoring plan consists of description of locations, staffing and methodology that will be employed to implement an archaeological monitoring program.

Archaeological or Historic Property: An archaeological resource that meets eligibility criteria for listing in the National Register of Historic Places or California Register of Historical Resources.

Archaeological Site Recordation: Archaeological site recordation is the process of recording the location and attributes of archaeological resources. In California, archaeological sites are recorded on California Departments of Recreation 523 Forms.

Archaeological Sensitivity Map: A map created upon completion of the historic properties identification effort that depicts areas of archaeological sensitivity that require archaeological monitoring during construction. This map will be incorporated into the Construction Monitoring Plan and used as a basis for communication with the Project Construction Manager to ensure that the PI is notified in advance when construction is proposed to occur in such areas so that archaeological and Native American monitoring can be arranged accordingly. The Archaeological Sensitivity Map will be developed in a Geographic Information System to be made available to the design-build team to use in the production of construction plans, and format(s) useful for the archaeological team.

Archaeological Text Excavation: Archaeological test excavations are performed to determine the vertical and horizontal extents of archaeological sites and determine whether archaeological deposits contain information that makes them legally significant. This information is then used to develop strategies to extract and analyze that data through data recovery excavations.

Area of Potential Effects (APE): The geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties.

Artifact: An object that has been intentionally made or produced for a certain purpose.

Construction Work Package: A construction work package is a component of a construction job or work which is noticeably discernible from other work packages. It has an assigned financial plan which is incorporated with the schedules of linked work packages.

Contractor: The Design-Build Contractor contracted to build the project.

Data-Recovery Excavation: Also referred to as "Phase III Excavation". Data recovery excavations are excavations undertaken once an archaeological feature or resource has been evaluated as NRHP-eligible, and the decision has been made to recover additional data from affected portions of the site as a mitigation measure.

Design-Build Project: Design- Build is a project delivery system used in the construction industry in which the design and construction services are contracted by a single entity known as the design–builder or design–build contractor.

Extended Phase I Investigation: The Extended Phase I (XPI) study is an extension of the identification phase. The chief goal of the XPI study is to define part or all of the boundaries (horizontal or vertical) of an archaeological site.

Ground-Disturbing Construction Activity: These activities include, but are not limited to, the excavation of geotechnical work, borings, utility trenches, ground surface grading, clearing and grubbing, and excavation of footings during construction.

Memorandum of Agreement: A memorandum of agreement (MOA) is a document that evidences the agency's compliance with Section 106 and records the outcome of consultation and the effects of an agency's project, projects or program on historic resources.

Phase II Excavation or Investigation: see "Test Excavation."

Phase III Excavation: see "Data Recovery Excavation."

Phased Historic Property Identification: Phased historic property identification refers to the process outlined in Section 106 of the National Historic Preservation Act whereby a federal agency official may use a phased process to conduct identification and evaluation efforts in circumstances where alternatives under consideration consist of corridors or large land areas, or where access to properties is restricted. As specific aspects or locations of an alternative are refined or access is gained, phased identification and evaluation of historic properties is conducted.

Programmatic Agreement: A programmatic agreement (PA) is a document that spells out the terms of a formal agreement between federal agencies, state agencies, and other signatories and concurring parties to resolve potential adverse effects of a program, complex undertaking, or multiple undertakings, in compliance with Section 106 of the National Historic Preservation Act. A PA establishes an alternate process from Section 106's implementing regulations (CFR Part 800) for consultation, review, and compliance.

Test Excavation: Also referred to as "Phase II excavation." Test excavations are archaeological excavations, typically limited in scope, undertaken to evaluate an archaeological feature or site for NRHP eligibility.

Unanticipated Discovery: A discovery that would require project construction to stop so that the nature of the find could be evaluated. Unanticipated discoveries that could be encountered during construction can include artifact (historic or prehistoric) deposits, archaeological features (e.g., foundations, wells, privies, and hearths), or human remains and associated grave goods.

1.0 Background and Summary

1.1 Regulatory Background for High-Speed Train Project

The High-Speed Train (HST) Project consists of the construction of approximately 800 miles of new rail alignment for a statewide HST system which will connect Northern and Southern California (Figure 1.1). The purpose of this ATP is to assist the project proponent, the California High-Speed Rail Authority (Authority), and the lead federal agency, the Federal Railroad Administration (FRA), in complying with Section 106 of the National Historic Preservation Act of 1966 (Section 106). Because of the geographic scope of the HST Project, a Programmatic Agreement (PA) was developed (Authority and FRA 2011a) to prescribe a process for program-wide compliance with Section 106. The PA defines each of the geographic "sections" of the larger HST system as a separate undertaking for the purposes of Section 106, and requires the development of a Memorandum of Agreement (MOA) for each HST section. The chief purpose of the MOAs is to address adverse effects to known historic properties (including archaeological properties), and to address the implementation of post-review historic property identification and treatment efforts for any currently-unknown historic properties that may be encountered.

The Fresno to Bakersfield Section (FB Section) of the HST Project extends from the southeastern portion of the City of Fresno southward to the eastern part of the City of Bakersfield (Figure 1.2). The MOA for the FB Section was executed in May of 2014 (Authority and FRA 2014a). Stipulation V of the MOA calls for the preparation of two treatment plans: an Archaeological Treatment Plan (ATP) and a Built Environment Treatment Plan (BETP). Pursuant to that stipulation, this ATP provides detailed descriptions of treatment measures for both known and unknown archaeological resources. This ATP also addresses the treatment of any archaeological resources that would be significant under the California Environmental Quality Act (CEQA), as defined in Section 6.2.

1.2 Status of Section 106 Compliance for Archaeological Resources

At the time of the development of this ATP, archaeological survey coverage has been limited to approximately 30% of the archaeological APE due to lack of permission to enter private landholdings. The current level of design for the Fresno to Bakersfield Section is at an early stage of development (approximately 15% design). The inventory and evaluation reports, assessment of effects, MOA, and this ATP are based on this early stage of design.

Cultural resource investigations have been undertaken in accordance with the PA and in support of the EIR/EIS for the Fresno to Bakersfield Section (Authority and FRA 2010a, 2010b, 2010c, 2011b, 2013a, 2013b, 2013c, 2013d, 2013e, 2014b, 2014c, 2014d). A list of technical reports prepared in compliance with CEQA, NEPA and Section 106 is provided in Table 1.1.

This ATP directs that, as additional property access is obtained for pedestrian archaeological surveys, the remaining unsurveyed parcels will be inventoried, and any resources identified will undergo evaluation and mitigation, as necessary, before ground-disturbing activities commence. Following these post-review cultural resources investigation efforts, all relevant cultural resources documentation will be prepared, as appropriate, including supplemental versions of the following documents: Archaeological Survey Reports (ASRs), Archaeological Evaluation Reports (AERs), Historic Property Survey Reports (HPSRs), Findings of Effect (FOEs), and Treatment Plans (TPs). Because the Undertaking will be contracted and constructed using a Design-Build procurement process, this additional cultural resources investigation work and report preparation will be completed by the Design-Build Contractor (Contractor) under the direction of the Authority and in consultation with the other MOA signatories and concurring parties.

As the Design-Build process will result in further refinement and finalization of the project design, it is anticipated that modifications to the APE will be necessary. Therefore, the FRA and Authority will ensure that the APE for the Undertaking is modified, as necessary, in accordance with the PA and MOA, to reflect the final design of the project and that all post-review cultural resources investigations account for the final APE.

After the Contractor completes the cultural resources identification work and advances design to 100%, the Contractor at the direction of the FRA and Authority will propose a determination of effect for any revisions to the Undertaking and revisions to the treatment plans that result from the completion of inventory and evaluation and the final design process. Final supplemental treatment plans will be prepared by the Contractor, as appropriate, for each construction package located within the Fresno to Bakersfield Section. To address the Design-Build procurement process, it is anticipated that these final supplemental treatment plans will, at a minimum, be prepared for each of the construction packages; however, it may be necessary to prepare several final supplemental treatment plans in order to facilitate construction in certain areas or for specific activities, while the design for other areas or work is finalized later.

Three construction packages (CPs) are currently proposed for the Fresno to Bakersfield Section, consisting of CP-1C, CP-2/3 and CP-4 (Figures 2.1 and 2.2). The preliminary schedule to begin construction on CP-1C is late 2014, and the schedule for work to begin on CP-2/3 is spring/summer 2015. Table 10.1 presents a draft treatment schedule that will be updated as the construction schedule is finalized.

Through the measures outlined in this ATP, the FRA and the Authority, in consultation with SHPO and the other signatories, affected tribes, and other concurring parties to the MOA, will continue the process of:

- identifying presently unknown historic properties within the limits of construction;
- evaluating their eligibility for the National Register of Historic Places and California Register of Historic Resources (NRHP/CRHR);
- establishing a process to address design changes and their effects on historic properties; and
- identifying and implementing measures to avoid, minimize, or mitigate adverse effects on historic properties.

Table 1.1 Section 106 Technical Reports and Concurrence Dates

Report Title	Date	SHPO Comment Date
Historic Property Survey Report	June 2010, revised October 2011	February 6, 2012
Archaeological Survey Report	October 2011	February 6, 2012
Historic Architecture Survey Report	June 2010, revised October 2011	February 6, 2012
Supplemental Historic Property Survey Report	February 2013	April 2, 2013
Supplemental Archaeological Survey Report	February 2013	April 2, 2013
Supplemental Historic Architecture Survey Report	February 2013	April 2, 2013
Salón Juárez Traditional Cultural Property Study	September 2013	October 22, 2013
Second Supplemental Historic Property Survey Report	November 2013	December 13, 2013
Second Supplemental Historic Architecture Survey Report	November 2013	December 13, 2013
Draft Section 106 Findings of Effect	November 2013	December 13, 2013
Final FOE	February 2014	N/A
Geoarchaeological Investigations Report	May 2014	N/A
Memorandum of Agreement	May 2014	N/A
Draft ATP and Draft BETP	May 2014	June, 2014
Draft Final ATP and Draft Final BETP	July 2014	August, 2014

Figure 1.1 California High-Speed Rail Project

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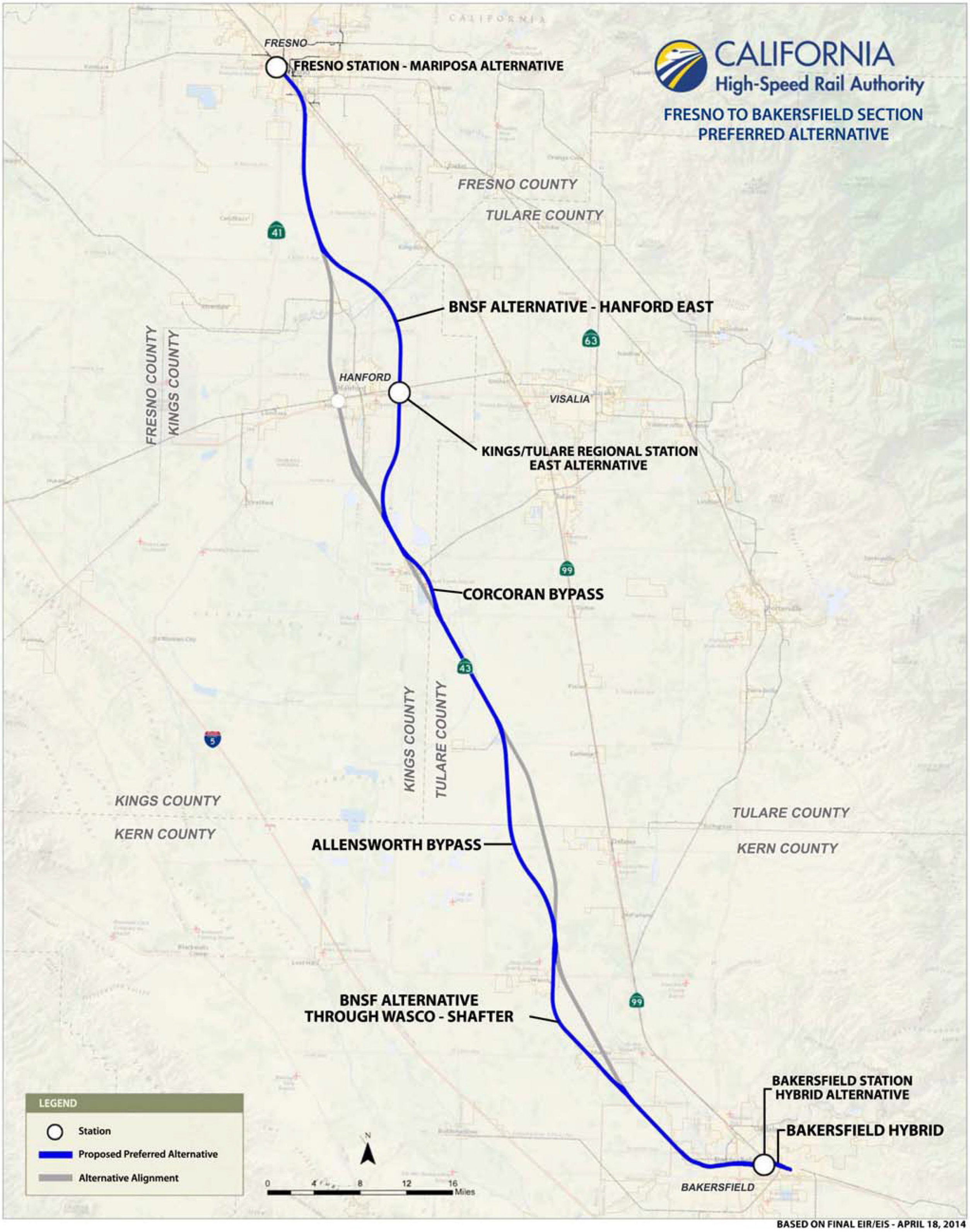

Figure 1.2 Fresno to Bakersfield Section of the California High-Speed Rail

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2.0 Description of Undertaking and Area of Potential effect

2.1 Description of the Undertaking

The Fresno to Bakersfield Section is one of nine "sections" that were identified in the Program EIR/EISs (Authority and FRA 2005, 2008). The nine HST sections, for which individual project-level EIR/EISs are being prepared, constitute a system that would connect the major population centers of the San Francisco Bay Area with the Los Angeles metropolitan region. The California HST System is planned to be implemented in two phases. Phase 1 would connect San Francisco to Los Angeles and Anaheim via the Pacheco Pass and the Central Valley. Phase 2 would connect the Central Valley (Merced Station) to the state's capital, Sacramento, and another extension would connect Los Angeles to San Diego.

The HST System is envisioned as a state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology system that would employ the latest technology, safety, signaling, and enhanced automatic train control systems. The trains would be capable of operating at speeds of up to 220 miles per hour over fully grade-separated, dedicated tracks.

The Fresno to Bakersfield HST Section would be a critical link in the Phase 1 HST System. In the 2005 Statewide Program EIR/EIS decision document, the Authority and the FRA selected preferred alignment corridors for most of the statewide system to be studied in more detail in second-tier EIR/EISs, including the BNSF corridor between Fresno and Bakersfield and downtown stations locations in Fresno and Bakersfield. Therefore, the project-level EIR/EIS for the Fresno to Bakersfield Section focuses on alternative alignments and station locations along the general BNSF Railway corridor.

The Fresno to Bakersfield Section EIR/EIS (Authority and FRA 2014b) evaluated 10 alignment alternatives. The Preferred Alternative extends from Downtown Fresno to Downtown Bakersfield and includes portions of the BNSF Alternative in combination with the Corcoran Bypass, Allensworth Bypass, and Bakersfield Hybrid alternatives (Figure 1.2).

The Fresno to Bakersfield Section would connect to the Merced to Fresno Section at the Fresno Station in the north and to the Bakersfield to Palmdale Section at the Bakersfield Station in the south. The Fresno to Bakersfield Section may also include a heavy maintenance facility (HMF).

The infrastructure and systems for the Fresno to Bakersfield Section are composed of trains (rolling stock), tracks, grade-separated right-of-way, stations, train control, power systems, and maintenance facilities. The design includes a double-track right-of-way to accommodate planned project operational needs for uninterrupted rail movement. Also, the HST System safety criteria preclude any at-grade intersections, and therefore the system must be grade separated from any other transportation system. This requirement means that planning the HST System also requires grade-separated overcrossings or under-crossings for roadways or roadway closures.

The Fresno to Bakersfield Section would consist of a fully dedicated rail line, constructed from continuous welded steel rail. Four different track profiles would be used: 1) At-grade profile, the at-grade track would be built at ground level on compacted soil and ballast material (a thick bed of angular rock) to prevent subsidence or changes in the track surface from soil movement; 2) Retained-fill profile, the guideway would be raised off the existing ground on a retained fill platform made of reinforced walls, much like a freeway ramp; 3) Retained-cut profile, the guideway would be below the existing ground level and the earth would be retained with reinforced walls; and 4) Elevated profile, the guideway is held above ground-level by pier supports. Types of bridges that might be built include full channel spans, large box culverts, or, for some wider river crossings, limited piers within the ordinary high-water channel. When the HST elevated profile crosses over a roadway or railway on a very sharp skew (degree of difference from the perpendicular), a straddle

bent would be used to ensure that the piers are outside of the functional/operational limit of the roadway or railway. The Mariposa station location in Fresno was selected by the Merced to Fresno Section EIR/EIS decision documents. With the preferred alternative alignments carried forward, the Tulare Visalia station location for the BNSF Alignment east of Hanford and the Bakersfield station alternative situated on the Bakersfield Hybrid Alignment.

Project facilities and related features, such as HMF site(s), radio transmission towers, offsite biological mitigation sites, maintenance of infrastructure facilities, and interconnections at power substations may be addressed in future Section 106 documents developed as part of the phased historic property identification effort consistent with the PA.

2.2 Description of the Area of Potential Effect

Section 106 of the NHPA requires that an APE be defined for the project. An APE is defined in 36 CFR §800.16(d) as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking; it may be different for different kinds of effects caused by the undertaking. For the Fresno to Bakersfield Section, the archaeological APE for the preferred alternative was established in accordance with Attachment B of the PA and in consultation with project engineers and the Authority. The archaeological APE for the Fresno to Bakersfield Section alternative is defined as the maximum extent of horizontal and vertical ground disturbance expected during construction. Ground-disturbing activities within the APE include grading, cut and fill, easements, staging areas, utility relocations, and borrow pits.

2.2.1 Horizontal APE

The horizontal APE is defined as the maximum horizontal extent of ground disturbances, and is defined at the present time as shown in engineering mapping depicting the project's "footprint". It is anticipated that the horizontal APE will need to be revised in the future as design refinements are made. The present horizontal APE is represented by the APE depicted in the mapping in Attachment A.

2.2.2 Vertical APE

The vertical APE is defined as the maximum vertical extent of ground disturbance. The vertical APE is not well understood at this time due to the early stage of design and the use of the design-build method of construction contracting. However, based on the current level of design, the subsurface disturbance expected for the majority of the project alignment would be to a depth of less than 6 feet. In urban settings, road crossings will consist of either bridge crossings or undercrossing; however, the exact depths of these under crossings or footings for bridge abutments are unknown at this time. The aerial structures constructed in many areas along the alignment would require piles that would be driven into the subsurface, in some cases 40 to 100 feet below grade. In these instances the extent of disturbance would be limited to the diameter of the piles, and immediately surrounding areas, which is currently unknown. Other elements of the project are also likely to result in subsurface disturbance, such as utility corridors, access roads, and laydown areas. Information about the depths of disturbance associated with these elements will become available as design is finalized.

2.2.3 Future Changes to APE

The APE reported in this document reflects the current level of design for the Undertaking; however, as discussed above, finalization of the project design is anticipated to result in the need to modify the APE. As design proceeds, these specifics regarding the subsurface APE provided

here and shown in Attachment A will require that the APE delineation be revised and the requirements for review and approval outlined in Section 9.2 be completed.

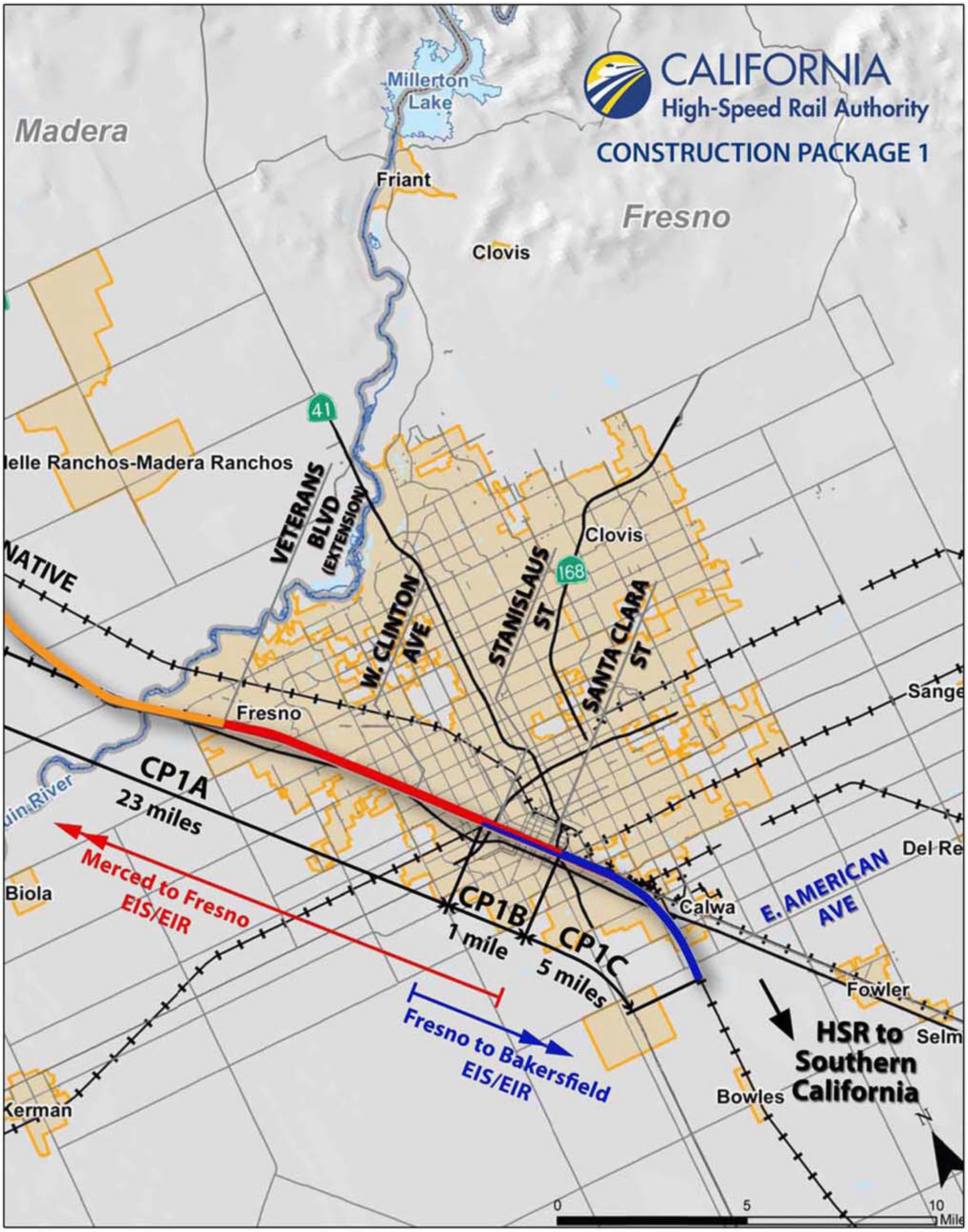

Figure 2.1 Construction Package 1C

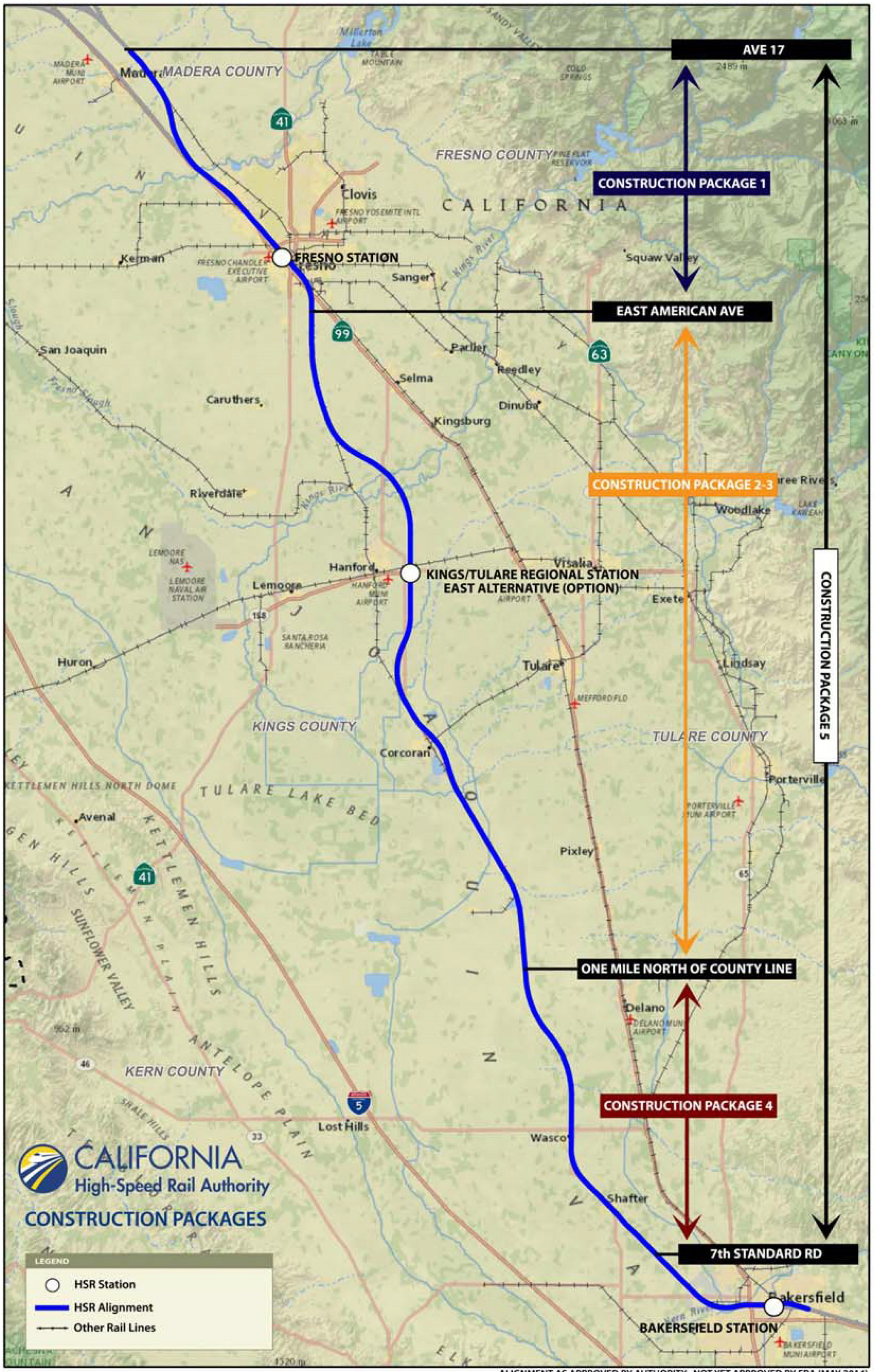

Figure 2.2 Construction Packages 2/3 and 4

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3.0 Roles, Responsibilities, and Qualifications

The Authority and FRA will oversee implementation of this ATP and have the primary responsibility to ensure compliance with the terms of the PA, MOA, and this ATP. The Surface Transportation Board (STB) and the U.S. Army Corps of Engineers, Sacramento District (Corps) are federal agencies with jurisdiction over this project; however, they have delegated the responsibility of compliance with this ATP to the FRA and Authority. The Authority may delegate some of the oversight of the work to their contracted delegates, including the Project Construction Manager (PCM), but will retain oversight responsibilities to ensure the project remains in compliance with Section 106. Implementation of the work described in this plan will be undertaken by the Contractor unless otherwise noted. The Contractor will be required to retain professional staff meeting the qualifications requirements outlined in the MOA and in Section 3.4 of this ATP to undertake the tasks outlined in this ATP.

3.1 Signatory Parties to MOA

3.1.1 California High Speed Rail Authority

The Authority is the lead agency for the California Environmental Quality Act (CEQA) and is also a signatory to the Fresno to Bakersfield MOA. The FRA has delegated the responsibility for the implementation of this ATP and the treatment measures included herein to the Authority. As part of its role, the Authority will review and approve the deliverables as outlined in this ATP in cooperation with FRA. The Authority is responsible for submitting all deliverables required by this ATP to the SHPO. The Authority is also responsible for coordinating with concurring parties and the SHPO and circulating deliverables to and obtaining comments from the signatories and concurring parties, in accordance with the PA.

3.1.2 Federal Railroad Administration

The FRA is the federal lead agency under Section 106 and the National Environmental Policy Act of 1969 (NEPA). As the lead federal agency, the FRA has primary responsibility to ensure that the provisions of this ATP are carried out. As part of its role, FRA reviews and approves the deliverables outlined in this ATP in cooperation with the Authority.

3.1.3 Surface Transportation Board

The STB has jurisdiction over this project and is a signatory to the Fresno to Bakersfield MOA. The STB has delegated the work necessary to comply with the MOA and treatment plans to the FRA but has retained review responsibility and authority for ensuring that deliverables prepared pursuant to this ATP meet the STB's requirements for Section 106 compliance.

3.1.4 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers, Sacramento District (Corps) also has jurisdiction over this project and is a signatory to the Fresno to Bakersfield MOA. Similarly to STB, the Corps has delegated the work necessary to comply with the MOA and treatment plans to the FRA but has retained review responsibility and authority for ensuring that deliverables prepared pursuant to this ATP meet the Corps' requirements for compliance with Section 106 of the NHPA.

3.1.5 California State Historic Preservation Officer

The California State Historic Preservation Officer (SHPO) is a signatory to the MOA and is responsible for reviewing the deliverables in this ATP and overseeing Section 106 compliance at the state level.

3.1.6 Advisory Council on Historic Preservation

In their role as a signatory to the MOA, the Advisory Council on Historic Preservation (ACHP) will be provided the opportunity to review and comment on deliverables prepared pursuant to this ATP. Both the PA and the Fresno to Bakersfield MOA provide a role for the ACHP in the resolution of disputes regarding implementation of the MOA.

3.2 Concurring Parties to MOA

In addition to the signatories to this MOA, there are a number of concurring parties to the MOA and ATP who are responsible for reviewing the deliverables in this ATP and providing comments within the timeframes identified. The concurring parties to the MOA include:

- California Department of Parks and Recreation
- The City of Fresno
- The City of Bakersfield
- The City of Corcoran
- City of Shafter
- Sociedad Juárez Mutualista Mexicana
- Santa Rosa Tachi Yokuts Tribe
- Table Mountain Rancheria
- Picayune Rancheria of the Chukchansi Indians
- Tule River Indian Tribe
- Kern Valley Indian Council
- Tejon Indian Tribe

The concurring party review process for the ATP deliverables is described in Sections 13.2 and 13.3.

3.3 Implementing Parties for MOA and ATP

Implementing parties are the entities and personnel who will actually implement the terms of the MOA and ATP.

3.3.1 Authority Representative (AR)

The Authority Representative (AR) is a professional archaeologist or architectural historian on the staff of the California High Speed Rail Authority who meets the Secretary of the Interior's Qualification Standards as outlined in 36 CFR Part 61. The AR has the authority to guarantee that all activities related to archaeology are completed to the highest possible standards and in conformance to the requirements of the PA, MOA and this ATP.

The AR is responsible for:

- overseeing the implementation of the cultural resources commitments described in this ATP;
- ensuring that all archaeological resources identified during construction activities are appropriately evaluated and treated in accordance with this ATP;

- serving as the point of contact for the FRA, SHPO, the PCM, concurring parties (including Native American groups and monitors), and the PI regarding the implementation of the commitments of this ATP;
- tracking the progress of all cultural resources commitments performed pursuant to this ATP;
- reporting and concurring with the FRA and the SHPO on any stop-work order, the nature of the concerns or issues that prompted them, and the resolution;
- coordinating with the tribal representatives to identify Native American monitors to participate in the monitoring of archaeological excavations and construction activities; and
- serving as the point of contact for resolving disputes or issues involving federally and non-federally recognized Native American tribes (while recognizing that federally-recognized tribes can request direct consultation with FRA as well).

3.3.2 Project Construction Manager (PCM)

The Authority will retain a Project Construction Manager (PCM) who will be responsible for the execution of construction orders, ensuring environmental compliance requirements are met, and the supervision of all contractors.

The PCM will designate an Environmental Lead who, as an agent of the Authority, is responsible for:

- coordinating with the AR and PI in the implementation of the requirements of this ATP;
- ensuring that, in the event of an unanticipated discovery, the AR is contacted, and that the PCM l implements a stop-work order at the direction of the PI;
- serving as the primary point of contact and facilitator of communications between the PI and the AR;
- notifying the AR and the PI of the Contractor's construction schedule in locations identified for archaeological monitoring (as depicted on the Archaeological Sensitivity Map);
- ensuring that the Contractor's staff receives the required Cultural Resources Worker's Awareness Training described in Section 10.1.7; and
- ensuring that the Contractor's team compiles a weekly log of archaeological activities conducted onsite (this log will include the daily field reports prepared by the PI to be provided to the AR).

3.3.3 Design Build Contractor (Contractor)

While the Authority and FRA are ultimately responsible for complying with the requirements of this ATP, the Design-Build Contractor will be ultimately responsible for conducting the work as outlined in the Construction Package Request for Proposal and Bid Documents and Design-Build Contract Documents. The Contractor is responsible for knowing these requirements, including the timing for the completion of tasks and deliverables in relation to construction, including the required signatory and concurring party review periods under the PA and the MOA. The Contractor will delegate actual implementation of tasks to the CRCM, as described below in Section 3.3.4.

3.3.4 Design-Build Contractor's Cultural Resources Compliance Manager (CRCM)

The Contractor will designate a Cultural Resources Compliance Manager (CRCM) to oversee and coordinate the cultural resources compliance program in accordance with this ATP. In

accordance with PA Stipulation III, this individual must meet the qualifications of a historian, architectural historian, or archaeologist as set forth in the Secretary of the Interior's professional qualification standards and as required by the PA. The CRCM could also serve as the Archaeology Principal Investigator or the Principal Architectural Historian, as appropriate.

The CRCM is responsible for:

- Generally overseeing and coordinating compliance with the ATP and BETP;
- ensuring that the requirements of the ATP and BETP are met;
- providing quality control for the technical content of each cultural resource deliverable prepared by the Contractor's team;
- ensuring that the weekly compliance reports are submitted to the PCM and Authority in accordance with the requirements of this ATP and the BETP; and
- preparing and submitting to the PCM and Authority, for review and comment, semi-annual status reports, as required by the MOA.

3.3.5 Design-Build Contractor's Archaeology Principal Investigator (Archaeology PI)

The Contractor will retain an Archaeology Principal Investigator (PI) who meets the Secretary of the Interior's Qualifications Standards as outlined in 36 CFR Part 61, Appendix A for professional archaeologist. The Archaeology PI must have a minimum of a master's degree in anthropology (or a closely related field) with a specialization in archaeology. In addition, the Archaeology PI should have demonstrable experience in the identification and excavation of archaeological remains in California and in dealing with human remains and associated grave goods. Besides being responsible for implementing the terms of the ATP in the role of Archaeology PI, this individual could also function as the CRCM, as described in Section 3.3.4 above.

At the direction of and in consultation with the AR and the FRA, the Archaeology PI will oversee the implementation of the commitments in this ATP. In this capacity, the Archaeology PI is responsible for:

- ensuring that the Contractor's staff meet minimum qualifications as required by the PA and MOA and as outlined in the Secretary of the Interior's Professional Qualification Standards (48 FR Part 44716).
- overseeing and coordinating the team of professional archaeologists, as well as Native American monitors, during archaeological inventories, excavations, laboratory work, and construction monitoring.
- coordinating the cultural resources monitoring requirements during construction;
- being the point of contact for Archaeological and Native American Monitors, including notifying tribal representatives, as identified by the AR, of the schedule and location for Native American monitoring;
- issuing a stop-work order and contacting the PCM, who will implement a stop-work order at the location of the archaeological discovery;
- contacting the PCM to resume operations once the issues that led to the stop-work order have been resolved;
- completing the field investigations associated with stop-work orders;
- making recommendations to the AR regarding the significance of an archaeological find for which a stop-work order was issued;
- preparing all archaeology technical reports produced to meet the commitments of this ATP;
- keeping a daily record of all field activities; and
- providing a weekly progress report of all those activities to the PCM (who will provide to the AR).

3.3.6 Archaeological Monitors

Archaeological Monitors will work under the direct supervision of the Archaeology PI. Archaeological Monitors will be present during all construction activities resulting in initial soil disturbance within areas of archaeological sensitivity. The Archaeological Monitors will have at a minimum a bachelor's degree in anthropology with a specialization in archaeology and have experience monitoring construction activities for archaeological resources. Each Archaeological Monitor will be equipped with a cell phone and camera to allow them to effectively and efficiently communicate with other team members, such as the Archaeology PI and AR.

Besides their core function of physically monitoring construction work, Archaeological Monitors are also responsible for:

- issuing temporary work stoppages to permit a closer view of a potential discovery (but do not have the authority to issue a stop-work order, which is a responsibility of the Archaeology PI);
- reporting to the Archaeology PI any concerns or issues related to archaeological or cultural finds on the construction site within the APE that may require further investigation; and
- documenting their activities in a daily log, which will be delivered to the Archaeology PI at the end of each work day.

3.3.7 Native American Monitors

The AR will invite Native American representatives to monitor during Phase II testing and data recovery excavations in the APE prior to construction on prehistoric sites, and during construction activities resulting in soil disturbances within areas of cultural resource sensitivity (as identified in the Archaeological Monitoring Plan). The AR will identify which Native American tribes will provide monitors and will convey the necessary contact information to the PCM and Contractor. Tribes who are concurring parties to the development of the MOA and ATP will be given priority for monitoring.

Native American Monitors will work in coordination with the Archaeology PI, who will notify them in advance of the schedule and location for cultural resource monitoring activities and pair them with an Archaeological Monitor. Each Native American Monitor will be teamed with an Archaeological Monitor.

Besides their core functions of representing tribal interests and physically monitoring construction work, Native American Monitors' key responsibilities also include:

- immediately reporting any archaeological or cultural finds observed within the APE to the onsite archaeological monitor for assessment;
- reporting any concerns or issues related to archaeological site monitoring to the Archaeology PI and PCM, who will elevate issues, if necessary, for resolution to the AR (Native American monitors may also contact the AR directly if they have concerns); and
- informing their tribal group, as appropriate, of construction activities, cultural resources discoveries, and cultural resources activities (e.g., testing, data recovery, etc.).

Native American monitors do not have the authority to halt equipment (responsibility of Archaeological Monitor) or issue a stop-work order (responsibility of Archaeology PI).

3.4 Qualifications of Staff Implementing the ATP

The qualifications requirements for conducting work for the CAHST project are outlined in PA Stipulation III, which requires that all actions that involve the identification, evaluation, analysis, recording, treatment, monitoring, or disposition for historic properties, or that involve reporting or documentation of such actions in the form of reports, forms, or other records, shall be carried out by or under the direct supervision of a person or persons who meet, at a minimum, the Secretary of the Interior's Professional Qualifications Standards (48 FR Part 44716) in the appropriate discipline.

MOA Stipulation VIII.A further stipulates that the Authority and FRA will ensure that professionals implementing any of the provisions in the MOA, this ATP, and/or the BETP are appropriately qualified to undertake such tasks. To ensure that these requirements are met, prior to any work being conducted, the cultural resources staff will be approved by the AR. Furthermore, prior to implementation of this ATP, a list of key individuals, their roles and their respective contact information will be prepared and distributed to all pertinent project personnel, the PCM and the AR. Alternative back-up individuals will be identified in the case that the designated individuals are not available when needed. The following are key entities for the purposes of this ATP:

- Authority Representative (AR);
- Project Construction Manager (PCM);
- Design-Build Contractor (Contractor)
- Cultural Resources Compliance Manager (CRCM) for Contractor; and
- Archaeology Principal Investigator (Archaeology PI) for Contractor.

Resumes for other cultural resources technical staff may be requested by the AR or PCM.

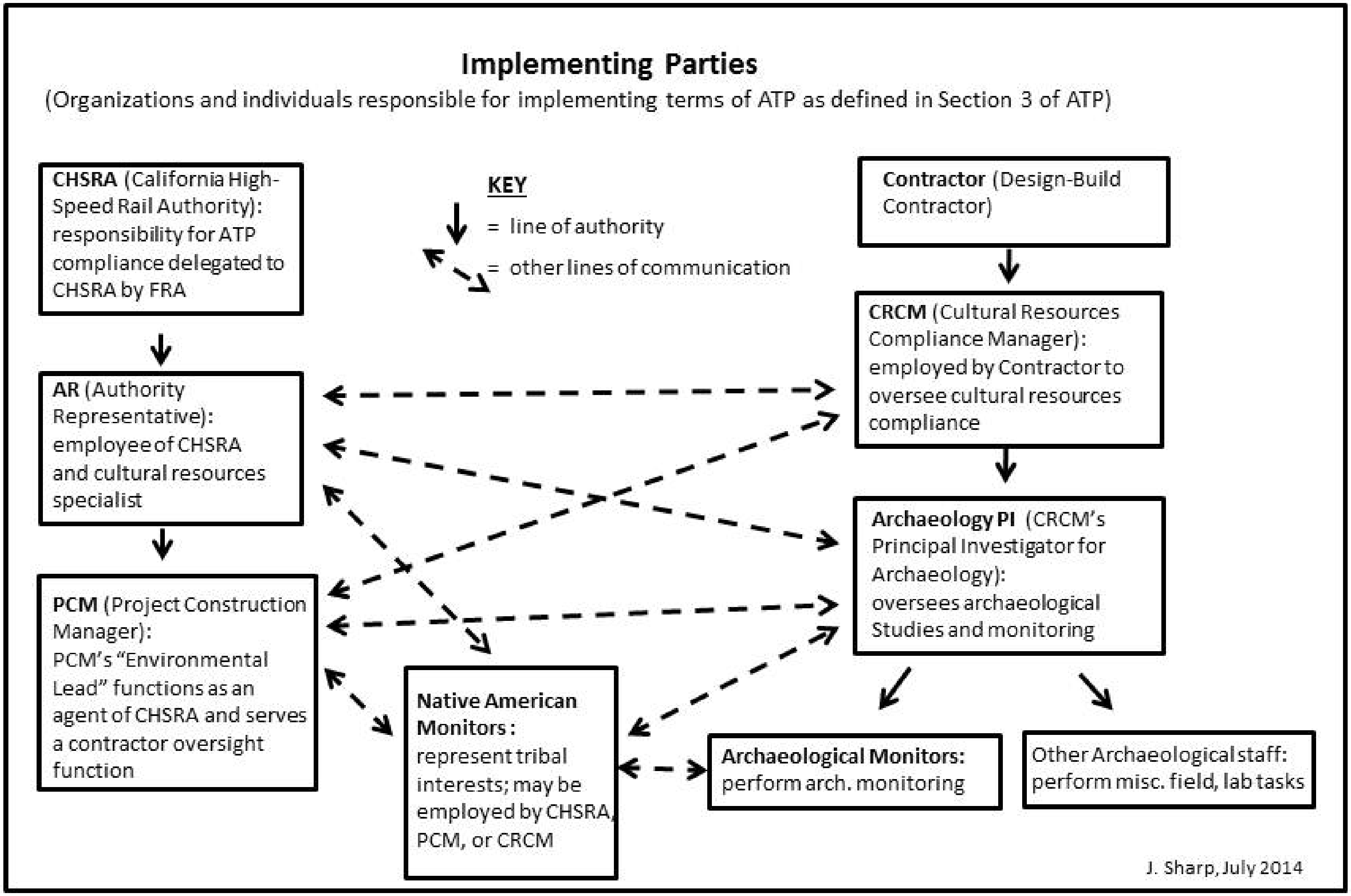

Figure 3.1 Organizational Chart for ATP Implementing Parties

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4.0 Prehistoric Archaeological Context

4.1 Overview

As a result of local geomorphic processes and historic-era land use practices, which have buried or destroyed archaeological sites throughout the region, there are limitations to the understanding of the prehistory of the southern San Joaquin Valley. Despite these limitations, there is a long history of archaeological research that informs current understanding of the prehistory of the region. Research conducted within the southern San Joaquin Valley has resulted in the identification and definition of a number of temporal components, periods, or phases that reflect prehistoric human lifeways and land use patterns. This research has predominately focused on sites situated along the ancient shoreline of Buena Vista Lake (Fredrickson and Grossman 1977; Gifford and Schenck 1926; Hartzell 1992; Riddell 1951; Walker 1947; Wedel 1941) and in the Tulare Basin area (Angel 1966; Hewes 1941; Siefkin 1999).

Archaeological research conducted by Hartzell (1992) at sites along the southwestern margin of Buena Vista Lake (Wedel Site #1 and #2; CA-KER-116) and near Buena Vista Slough (CA-KER-180 and CA-KER-1611) has resulted in the refinement of the lakeshore's chronological sequence as it relates to the Holocene epoch. A similar approach was taken by Siefkin and colleagues (Siefkin et al. 1996) for the neighboring Tulare Basin area. Cumulatively, these studies define three broad temporal periods for the larger southern San Joaquin Valley area: (1) Early Holocene, (2) Middle Holocene, and (3) Late Holocene. While no single cultural-historical framework currently exists that represents the entire prehistoric record for the Central Valley, this chronological sequence best describes the cultural changes for the purposes of this document. Table 4.1 depicts the concordance with the following sequence and other frequently used chronologies for the San Joaquin Valley and the Central Valley as a whole.

Table 4.1 Prehistoric Cultural Periods

Dates	Temporal Period	Cultural Period	Sub-Period
A.D. 500–1850 (Protohistoric, Contact Period, Historic)	Late Holocene	Late Prehistoric	
2,000 B.C.–A.D. 500		Archaic	Upper
3,000–2,000 B.C.	Middle Holocene		Middle
5,000–3,000 B.C.			Lower
10,000–5,000 B.C.	Early Holocene	Paleo-Indian	
Sources: Fredrickson [1983] 1986; Hartzell 1992.			

4.1.1 Early Holocene (12,000 to 7000 B.P.; 10,000 to 5000 B.C.)

The earliest period of human use of the southern San Joaquin Valley dates to approximately 12,000 years ago (10,000 B.C.). During this time, the archaeological record suggests that native peoples lived in camps around lake margins and relied extensively on lake-related resources (i.e., fish, turtle, freshwater mollusks, and waterfowls) and terrestrial mammals.

Populations are considered to have been small, based on the absence of imported items and the use of local resources from within a relatively restricted area centered on the lake marshes and the surrounding plains and foothills. Late Pleistocene/Early Holocene cultural deposits found in

the Tulare Lake and Buena Vista Lake basins indicate that forms of large hunting-related tools characterized the assemblage (Hartzell 1992:317–331; Siefkin 1999:50). Also noted with these artifacts were species of extinct megafauna, although direct cultural association has not been proven (Siefkin 1999:49).

Fluted points have yet to be identified at Buena Vista Lake, a factor that Sutton (1996) correlates with the absence of a lake habitat during the early human occupation of the southern San Joaquin Valley. Artifact distribution at Tulare Lake, however, indicates that water levels were lower during the Late Pleistocene, a trend that was likely reflected by Buena Vista Lake (Wallace and Riddell 1988:89). Siefkin (1999:51) considers the modern archaeological emphasis on the upper shorelines a more reasonable answer to the current lack of fluted points and other Paleo-Indian remains at Buena Vista Lake.

4.1.2 Middle Holocene (7000 to 4000 B.P.; 5000 to 2000 B.C.)

Few well-stratified archaeological deposits from the southern San Joaquin Valley date to this period. The paucity of such sites has been attributed to fluctuating lakeshores and the movement of campsites to locations above or below areas that have been previously studied by archaeologists (Hartzell 1992:318; Siefkin 1999:52).

This period is characterized by assemblages that are similar to Windmiller Pattern sites in the northern part of the San Joaquin Valley, including extended burials without funerary objects, Pinto projectile points, and charmstones; however, some local deposits more closely resemble the Oak Grove and other millingstone complexes of southern California, with millingstones, handstones, and flake scrapers (e.g., Gerow 1974; Gifford and Schenck 1926; Hartzell 1992; Siefkin 1999; Wallace 1954:120–121). While conclusions are tenuous based on the very limited assemblages for this time, this may suggest cultural affiliation with the northern parts of the Central Valley (Windmiller) as well as southern California and the coast (Oak Grove).

From archaeological evidence, it appears that year-round acquisition of fauna occurred at lakeshore sites, and many logistical bases were set up along lakeshores. Rises above the lakes were likely used by hunting parties to retool weaponry and/or process game (Hartzell 1992:320).

4.1.3 Late Holocene (4000 B.P. to 150 B.P.; 2000 B.C. to A.D. 1850)

In contrast to earlier periods, the archaeological record of the Late Holocene period is significantly more complex. During the Late Holocene period, with the lowering of water levels and greater alkalinity in the area lakes (resulting in less abundant and reliable resources), a residential mobility pattern of land use began. This strategy involved more frequent moves, where an entire population or group traveled to resource areas.

Notable technological changes include the introduction of the hopper mortar, changes in Olivella shell bead forms, and the use of asphaltum in small quantities (Fredrickson [1983] 1986; Hartzell 1992:326). Also introduced into the tool kit were Cottonwood series projectile points, bi-pointed bone objects used as fish hooks, steatite H-shaped line holders manufactured from soapstone, and tule-covered clay ball net weights. Late-Holocene–period sites often contain freshwater mussels, turtle remains, ground stone, and marine shell beads (Peak and Associates 1991), and they are generally found on knolls between ephemeral drainages (Hartzell 1992:328; Moratto 1984:189). Mortuary patterns included flexed or semi-flexed burials, somewhat similar to the Late Horizon of the Central Valley sequence.

The protohistoric period of the Late Holocene, dating from roughly 500 B.P. (A.D. 1500) to the ethnographic period, is represented by a diversified artifact assemblage. Common implements included baked clay objects, triangular projectile points, elaborate bone work, bowl hopper

mortars, Olivella disk beads, Haliotis beads and ornaments, clamshell disk beads, and small steatite pendants and carvings (Fredrickson [1983] 1986).

4.1.4 Ethnographic Period

The present-day southern San Joaquin Valley is in the homeland of the Southern Valley Yokuts (Wallace 1978:448, 449), a geographic division of the much larger Yokuts linguistic group, who occupied the entire San Joaquin Valley and adjoining Sierra Nevada foothills (Kroeber 1907, 1925, 1963; Latta 1977; Newman 1944). Yokutsan is one of four Penutian linguistic stocks, which included Costanoan (Ohlonean), Miwok (Utian), Wintu, Nomlaki, and Patwin (Wintuan), and the Maidu, Nisenan, and Koncow (Maiduan) (Shipley 1978).

In contrast to the typical California cultural grouping known as the tribelet, the Yokuts were organized into "true tribes," in that each had "a name, a dialect, and a territory" (Heizer and Whipple 1971:370). Kroeber (Kroeber 1925:474) estimated that as many as 50 Yokuts tribes may have originally existed, but that only 40 were "sufficiently known to be locatable" at the time of his survey. Each tribe inhabited an area averaging "perhaps 300 square miles," (777 square kilometers) or about the distance one could walk in any direction in half a day from the center of the territory. Some Yokuts tribes only inhabited a single village, while others occupied several (Kroeber 1925:474–475).

The Southern Valley Yokuts territory was centered near the basins of Tulare, Buena Vista, and Kern lakes, their connecting sloughs, and the lower portions of Kings, Kaweah, Tule, and Kern rivers. Sixteen subgroups, each speaking a different dialect of the Yokut language, made up the Southern Valley Yokuts, and included the Apyachi, Choynok, Chuxoxi, Chunut, Hewchi, Hometwoli, Hoyima, Koyeti, Nutunutu, Pitkachi, Tachi, Telamni, Tulamni, Yawelmani, Wowol, and Wechihit. Three of the groups—the Tachi, Chunut, and Wowol—claimed the shores of Tulare Lake, while the Nutunutu inhabited the swampy area north of Tulare Lake, south of Kings River. The Wimilchi, Wechihit, and Apyachi occupied the area to the north of Kings River; the Apyachi lived near the river's outlet on the western side of the valley, and the Wimilchi and Wechithit lived to the east. The Choynok occupied an area east of Tulare Lake in the Kaweah River Delta, southwest of the Telamni and Choynok groups. The Koyeti's territory was in the swampy sloughs of the Tule River. The Tulamni occupied Buena Vista Lake, while the Chuxoxi lived in the channels and sloughs of the Kern River Delta. The Hometwoli occupied the area surrounding Kern Lake, while the Kawelmani lived to the northeast near Kern River and Poso Creek (Wallace 1978:449).

Subsistence strategies focused on fishing, hunting waterfowl, and collecting shellfish, seeds, and roots. Fish species commonly hunted included lake trout, chubs, perch, steelhead, salmon, and sturgeon. Waterfowl were mainly caught in snares and nets. Plant foods played a key part in the Yokuts diet; the most important resource was tule, whose roots and seeds were eaten. Other plant foods included various species of grasses, clover, fiddleneck, and alfilaria. Acorns were not readily available, and groups often journeyed into foothill zones to trade for the nut (Wallace 1978:450).

Southern Valley Yokuts generally placed their settlements on top of low mounds near major watercourses, and constructed two types of permanent residences. The first was an oval, single-family dwelling with wooden framing covered by tule mats. The second type was a long, steep-roofed communal residence that housed at least 10 families. Other structures included granaries and a communally owned sweathouse (Wallace 1978:450, 451).

Southern Valley Yokuts relied heavily on tule reeds for making woven baskets and mats. Basketry tools, such as awls, were manufactured from bone (Wallace 1978:451, 452). Flaked stone

implements included projectile points, bifacial and unifacial tools, and edge-modified pieces. Ground stone tools consisted of mortars, pestles, handstones, and millingstones.

Of particular relevance to the Bakersfield area was the Yowlumne tribe, a subset of the Yokuts, who occupied a number of village locations throughout the southern San Joaquin Valley. The Yowlumne tribe reportedly occupied the village of "Woilo at the site of the town of Bakersfield" (Kroeber 1925: 482). According to Latta (1977), the location of Woilo was reported to be on a knoll between present-day 16th and F streets and Mercy Hospital at 16th and C streets.

4.2 Known Prehistoric Archaeological Sites

There are two known prehistoric archaeological sites in the Fresno to Bakersfield Section, CA-TUL-473 and CA-KER-2507, which will require implementation of treatment measures. All other resources reported on in earlier technical reports were either found ineligible for the NRHP or CRHR or are not within the APE for the project.

4.2.1 CA-TUL-473

Site CA-TUL-473 was recorded by Davis and Cursi (Davis and Cursi 1977) as a "sparse scatter of lithic debitage and artifacts spread over a plowed field." No intact or discrete deposits were recorded. Given the proximity of this site to the former shore of Tulare Lake (no longer extant due to historic-period agricultural development), it appears to be a large site that had been disturbed and re-deposited over a large area, possibly due to the construction of bermed holding ponds that were constructed that are flooded as part of Alpaugh Irrigation District activities. A later survey undertaken just to the south for solar development (Orfila 2010) included a pedestrian survey of the southern boundary of the site; however no archaeological materials were noted as a result of that study. Based on this background information, the initial conclusion for the HST Project was that that CA-TUL-473 had been destroyed and is no longer extant (Authority and FRA 2011b). However, upon consulting with SHPO, SHPO stated that not enough information is available to determine whether the site is eligible for the NRHP (and hence the CRHR) and requested additional investigation be conducted at the site (SHPO 2013).

At the present time, the site area and immediate vicinity has been only partially resurveyed due to lack of access to approximately two-thirds of the parcels in the site area. After acquiring permission to enter some of the parcels in the site area, a team from URS surveyed several of the parcels in the mapped site location, and to the south and southeast of the mapped site location, in January of 2014 (Offerman 2014). The survey was confined to raised roads (i.e., on top of levies) in the mapped site location, and encountered no artifactual remains in the mapped site boundaries. However, numerous isolated artifacts were encountered in the parcels to the south and southeast of the mapped site location, suggesting light prehistoric use of the entire vicinity, perhaps over long periods of time. These findings are consistent with concerns expressed by Native Americans, as well as the results of the Geoarchaeological Investigation Report prepared for the Fresno to Bakersfield Section (Attachment B).

The CA-TUL-473 mapped site location and immediate vicinity require further archaeological study (pending parcel access), and will also be monitored during project construction, regardless of future study findings, due to the general sensitivity of this location.

4.2.2 CA-KER-2507

Site CA-KER-2507 was known anecdotally to have existed in the location of the BNSF railroad yard Bakersfield, along present-day 16th Street, between C and F streets, and extending south towards Bakersfield High School (Ptomey and Wear 1989; Latta 1949; Latta 1977). The site was originally identified in historic accounts as a small group of shelters located on a sandy hill

adjacent to the Kern River and surrounded by a marshy environment dominated by tule and cattails. At the time, an arm of the Kern River ran near the intersection of Truxtun and A Street (Latta 1949:47). The area was also known historically as "Reeder Hill" after a man who built a house there in the late 1800s. Latta reported that this location has been associated with the ethnographic village of Woilu (Latta 1949:46–47) and in his definitive ethnography of the Yokuts, he reports that the site was leveled for the construction of the Santa Fe Railroad in the 1890s and that the excavated sandy soils were used as fill along the railroad grade in both directions from Bakersfield. (Latta 1977). Latta reported that hundreds of mortars, pestles, and burials were removed from the site along with the fill. Based on Latta's (1949) description it appears that the hill may have actually been a mound site.

In 1776, Spanish missionaries visited the area now known as Bakersfield; the event was documented by Franciscan Friar Francisco Garces. Father Garces described the Kern River, which he named Rio de San Felipe, and visited the Yokut community of Woilu, a village situated on the land modern Bakersfield would later occupy. While visiting Woilu, Father Garces performed the first European baptism in the San Joaquin Valley. Latta confirmed the importance of Woilu in describing the tribe's political structure:

> Each Yokuts tribe was ruled by at least one chief. There were sub-chiefs at all larger villages. Each chief had at least one winatun or secretary. The head chief lived at the principal or head village. In Yowlumne territory this was Woilu on Reeder Hill, where now stands the Santa Fe passenger depot in Bakersfield. (Latta 1949:284).

The site record prepared for the site in 1989 (Ptomey and Wear 1989) appears to have been based partly on information reported in a 1956 newspaper article. From that source, the site was said to have had willow huts (or "wickiups") and shell beads and ornaments. The former location of the site is now completely developed, covered by portions of the BNSF switching yard and associated facilities, paved streets, parking lots, and buildings. No topography is currently evident in the area that would suggest this was the former location of a prehistoric/ethnographic mound site.

Previous archaeological excavation at CA-KER-2507 is limited to 21 trenches and 20 auger testing locations excavated as part of the planning for the now defunct Amtrak station at this location (Chase 1994). This testing program was conducted to determine if subsurface components from CA-KER-2507/Woilu were still present in a 6-acre area just south of 16th Street between D Street and Pine Street. That testing program went to depths of approximately five feet, and did not identify any archaeological deposits.

Access to the area is presently restricted due to its active use as a switchyard for the BNSF, and the entire area is covered with gravel and pavement (Authority and FRA 2010b). Consequently, the area was not surveyed for this project.

Although documentary evidence suggests that the site existed on a hill that was completely leveled and destroyed, the area is on the actively accreting fan of the Kern River and is considered to have high sensitivity for buried archaeological sites, based on geoarchaeological analyses conducted for the project (Authority and FRA 2010b). As such, construction in this area has the potential to disturb previously unrecorded subsurface archaeological deposits.

Given the previously reported destruction of the site and the results of the subsequent subsurface testing by Chase (1994), it was concluded that this site no longer exists. However, the SHPO indicated that not enough information was available to determine whether the site is eligible for the NRHP, or hence the CRHR, and requested that additional investigations be conducted at the site.

4.3 Anticipated Prehistoric/Ethnographic Archaeological Resources

Because the majority of the APE has not been surveyed for archeological resources, this ATP provides a description of the types of archaeological resources that are likely to be encountered in the APE. This information was used to inform the sensitivity analysis depicted on the draft Archaeological Sensitivity Map (Figure 4.2), which will be used to develop the required archaeological monitoring plan described in Sections 10.1.5 and 10.2.1, and to guide additional inventory efforts. There are three categories of anticipated prehistoric/ethnographic resources: (1) expected resources based on known recorded sites in the APE and project vicinity; (2) expected or predicted resources based on information supplied by Native Americans; and (3) predicted resources based on geoarchaeological research.

Recorded prehistoric archaeological sites within the APE are limited but include sites with artifacts disbursed over large areas as well as numerous isolated finds, both of which are due to widespread agricultural activities and development in the region. Because sites in the APE have been impacted by development and agricultural activities, one must look to the long history of archaeological research in the southern San Joaquin Valley to inform the present understanding of the prehistory of the region and to make conclusions about the prehistoric landscape of the APE. Starting in 1899 and extending until 1925, test excavations took place at more than 20 different sites around Buena Vista Lake and Slough and Tulare Lake, all focusing on the recovery of burials and grave goods from large village sites (Gifford and Schenck 1926). In 1926, Gifford and Schenck of the University of California published their volume on the archaeology of the southern San Joaquin Valley. The report included the documentation of approximately 40 sites, the results of their excavation of 9 sites, and the examination of private collections. This work was followed in the 1930s through 1960s by limited excavations in the southern San Joaquin Valley, primarily around Buena Vista Lake, by various researchers, including the Smithsonian Institute, Wedel, vonWerlhof, Warren, and Fredrickson, which also focused on larger village and burial sites (Schiffman and Garfinkel 1981).

During the Depression years of 1933 and 1934, the Civil Works Administration excavated five sites (two middens, two cemeteries, and a small grave site) next to the southwestern shore of Buena Vista Lake. The midden sites, CA-KER-39 and CA-KER-60, exhibited stratified deposits that represented both prehistoric and protohistoric/ethnographic occupations. Materials recovered from the two cemeteries, CA-KER-40 and CA-KER-41, appeared contemporaneous with materials from the upper deposits of CA-KER-39 and -60, suggesting that they may have been the burial grounds for the inhabitants of the midden sites. Reported upon by Wedel (1941), this investigation stands as the "most intensive scientific excavation work so far in the southern San Joaquin Valley" (Moratto 1984).

CA-KER-39 and -40 were subsequently found to be components of a much larger site, CA-KER-116. Excavated in the mid-1960s by Fredrickson and Grossman (1977), CA-KER-116 was found to contain a deeply buried component that was not identified by Wedel. Situated at depths of greater than 2.8 meters (9.2 feet), this component was dated to circa 6250 before Christ (B.C.) (Moratto 1984).

Sites recorded just 0.5-mile east of the project alignment are indicative of the broader archaeological sensitivity of the Tulare Lake vicinity. The majority of the most well-known and well-stratified archaeological sites in the region have been recorded along the 200-foot-elevation contour of the ancient lakeshore bed, which indicates the primacy of the Tulare Lake to San Joaquin Valley area peoples for their subsistence and settlement.

Although it lies about one mile east of the APE, CA-TUL-1613, or the Creighton Ranch site, merits discussion here. The dataset gathered from this site emphasizes the significance of the marshy margins of Lake Tulare to the prehistoric inhabitants, and thus the potential for prehistoric sites in that area. The contents of the site revealed large quantities of lake fish, freshwater clams, and turtles, in addition to large and small mammals. The data obtained at this site suggest that during the course of the site's occupation, the occupants shifted their subsistence patterns relative to ecological changes (Dillon et al. 1991; Porcasi 2000).

Five miles due west of the Creighton Ranch site is CA-TUL-90, a cemetery mound site excavated and reported by Warren and McKusick (Warren and McKusick 1959), and 20 miles northwest of CA-KER-74, another burial site (Riddell 1951). The Creighton Ranch site, dating to 1700 B.P., was contemporaneous with these two sites; however, the site may be even older because the deepest levels were not reliably dated (Dillon et al. 1991). The large quantities of tools and organic refuse at TUL-1613 indicate that the focus of the activities was food procurement and preparation rather than the habitation-related material identified at sites to the west. The APE is between these two site types (food procurement/processing and habitation/burial), suggesting the potential sensitivity for multiple archaeological site types within that portion of the APE close to Tulare Lake.

Another site, CA-TUL-212 (P-212), which is about 4 miles north of Corcoran, is also situated along the 200-foot-contour shoreline of the lake. TUL-212 was originally recorded in 2000 and was tested in 2003 (Fogerty 2003). This site was described as a surface concentration of lithics and shellfish fragments. The distribution of lithics and shell covered a 12,600-square-meter (135,625-squarefoot) area. The extent and concentrations of shell with a surface scatter of lithic debitage suggest that this site functioned as a seasonal resource procurement activity site. The flake stone debitage included obsidian, which suggests tool manufacture or resharpening of non-local materials (Fogerty 2003).

Collectively, the known recorded sites within and adjacent to the APE indicates that there is potential for multiple prehistoric archaeological site types within the portion of the APE that is close to Tulare Lake, including sites focusing on food procurement and preparation and habitation, as well as for use as cemeteries.

In terms of buried sites (archaeological sites with no surface manifestation), buried site potential is dependent on the presence of subsurface sediments of an appropriate age to harbor archaeological materials (i.e., sediments that post-date the late Pleistocene). This likelihood is considered much greater if a given landform contains buried soils (paleosols). These paleosols are representative of stable landforms that would have been exposed at the surface for an appreciable amount of time and thus more conducive to human occupation. In general, the younger the surface soils are on a depositional landform, the more likely that landform is to contain buried stable surfaces, and thus potentially harbor buried archaeological sites. As such, the more recent (late Holocene and latest Holocene) portions of the alluvial fan and basin deposits are the most sensitive for buried archaeological deposits.

Through correlation of mapped surface soil units, field observations, soil profile descriptions, and radiocarbon dates—compiled from existing studies, as well as original fieldwork conducted for Caltrans—Meyer et al. (2009) established a relational database of mapped soil series and landform age for the southern San Joaquin Valley. Their study is largely based on soils data obtained through the Soil Survey Geographic Database, which is a digital duplication of various original Soil Conservation Service soil survey maps. A re-creation of this landform age map, based on the published soil-age database (Meyer et al. 2009) is included below as Figure 4.1. This relational database is predicated on the theory that specific soils types are typically associated with specific depositional environments and landforms of a particular age. The degrees of soil profile development provided by official soil series descriptions were used to make

initial relative-age estimates. In addition to relative soil development, age estimates were also based on the geomorphic position of associated landforms, crosscutting relationships, degree and extent of erosional dissection, radiocarbon dates, and correlations with other dated deposits (Rosenthal and Meyer 2004).

However, archaeological sites are not distributed randomly on the landscape but are chosen as a result of human need and cognition. These considerations include access to resources, proximity to trade routes, and desire to mitigate conflict with surrounding populations. Unfortunately, many of these considerations are difficult to quantify and are dependent on cultural norms that are elusive (at best). Of the more easily quantifiable environmental factors, proximity to water has been determined to be the most strongly correlative factor with site location (Meyer et al. 2009). As a result, it is not a coincidence that both known and predicted (buried) resources are associated with shorelines of ancient Tulare Lake and tributary watercourses.

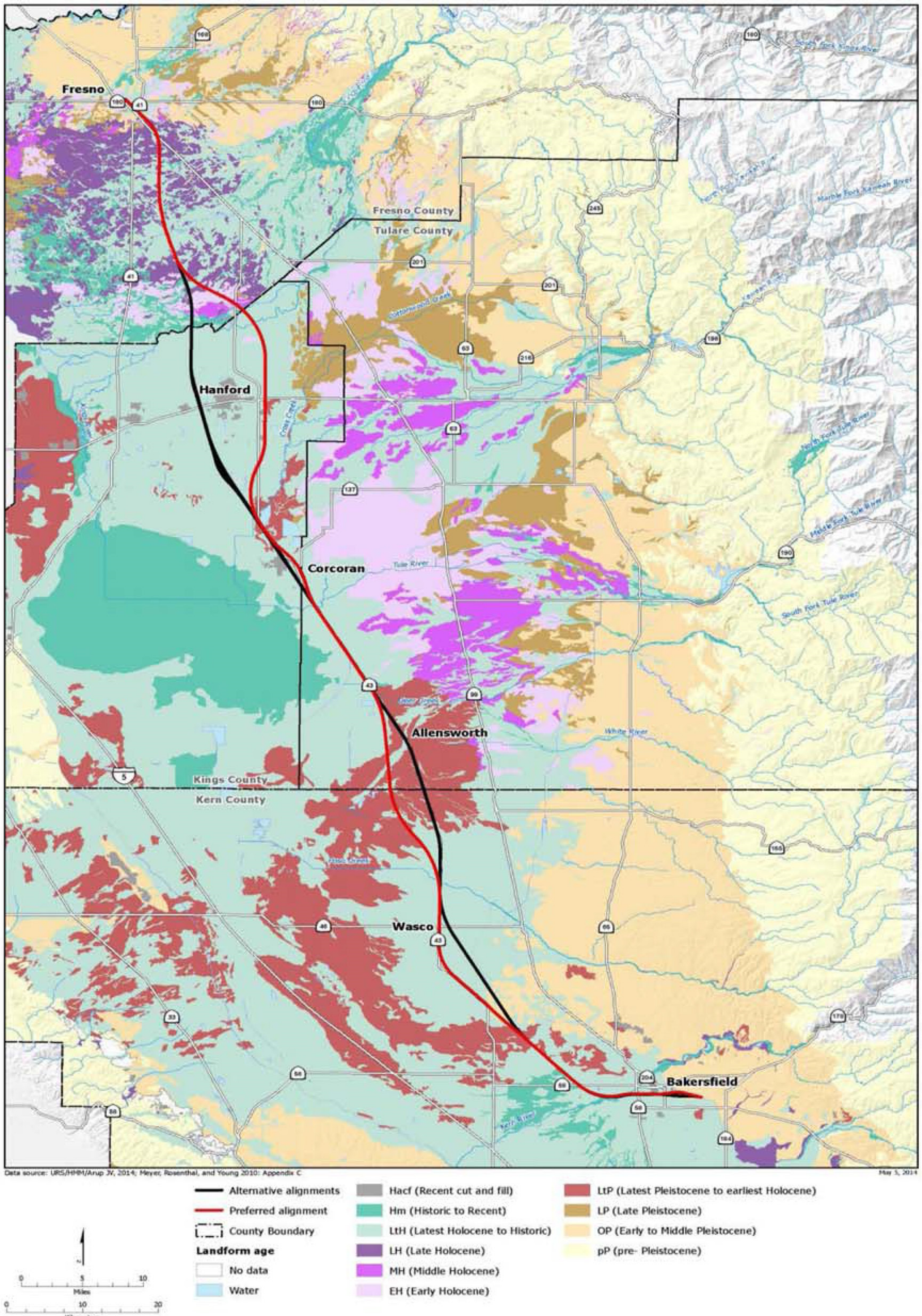

Figure 4.1 Project APE in Relation to Soil Types

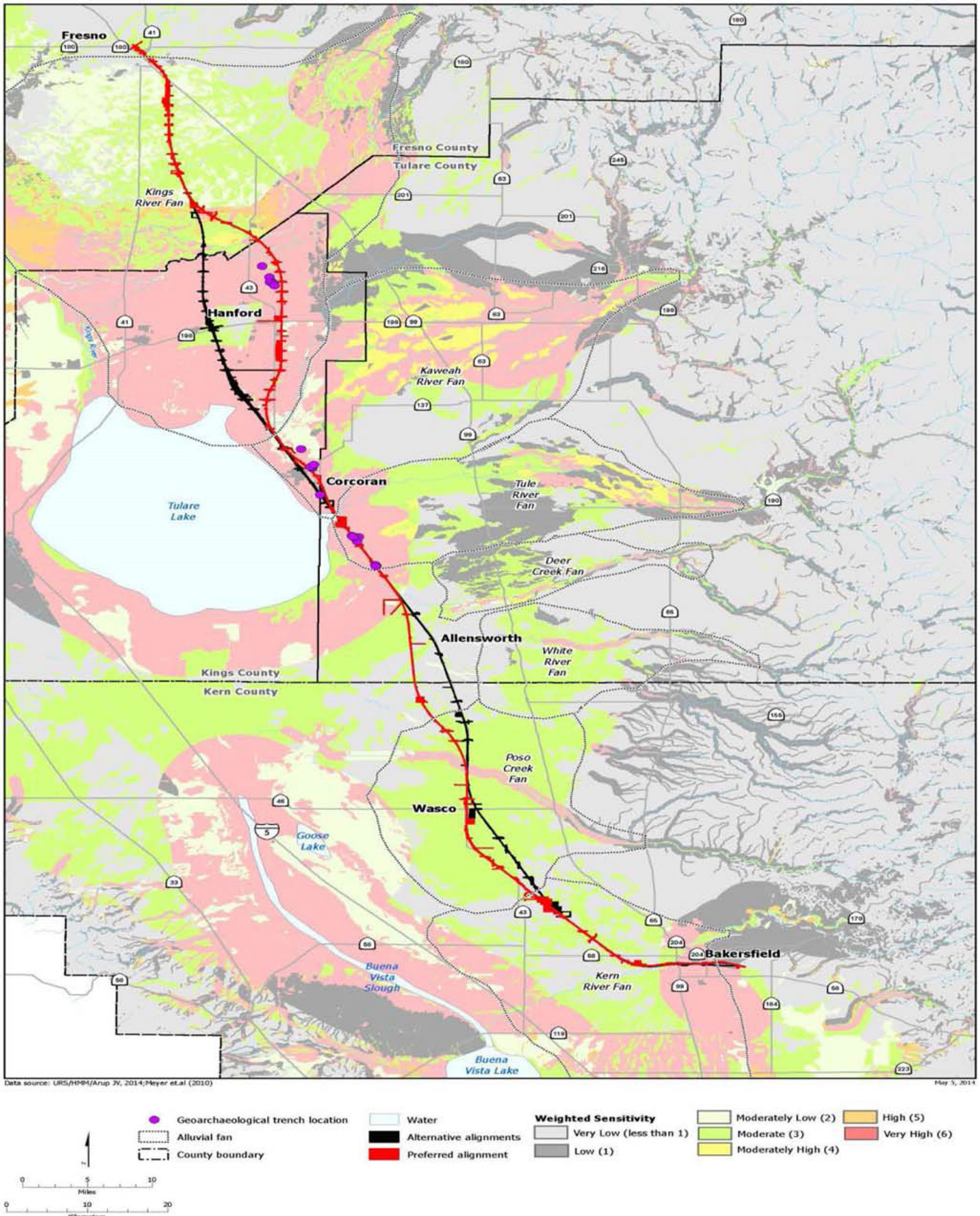

Figure 4.2 Sensitivity for Prehistoric Archaeology Based on Soils and Landform

5.0 Historic-Period Archaeological Context

5.1 Overview

Historic archaeological sites in California are places where human activities were carried out during the historic period, generally defined as beginning with contact in the mid-eighteenth century and ending approximately 50 years ago. Some of these are of Native American origin during the historic period, but most are the result of Spanish, Mexican, Asian, African-American, or Anglo-American activities. Most historic archaeological sites are domestic sites, places where houses formerly stood, and they tend to contain the types of household goods reflecting the economic standing and ethnic identity of their occupants. Remains of ceramic, metal, and glass containers and dishes are most common, together with remains of the materials used in house construction—nails, brick, plate glass. Historical archaeological sites can also be nonresidential, resulting from ranching, farming, mining, transportation, and other commercial and industrial activities. Some historical sites, like the Stoil town site (CA-TUL-2950H/P-54-4737), represent a confluence of human activities, including industrial, transportation, and residential. Human burials dating to the historic period may also be considered archaeological resources.

5.2 Known Historic-Period Archaeological Sites

Historic period deposits located in Fresno, including Fresno Chinatown, were reported on in the environmental documents for the Fresno to Bakersfield Section; however, these resources are being treated under Section 106 as part of the Merced to Fresno MOA and treatment plans.

There is also one traditional cultural property (TCP) within the Fresno to Bakersfield Section, which is the Salon Juarez in downtown Bakersfield. Due to the nature of the property, the required treatment is provided for in the BETP.

5.3 Anticipated Historic-Period Archaeological Resources

Because a very limited number of historic sites were identified in the APE, predictions of archaeological property types must rely on historical sources. Historic maps, including Sanborn maps, are the primary source for information regarding anticipated historic period archaeological sites that could be located within the APE.

Sanborn maps were generally available for all urban areas in the project vicinity, including Fresno, Hanford, Wasco, Shafter, Bakersfield, East Bakersfield, and Sumner (incorporated into East Bakersfield in 1910). The dates of the maps vary by location, with larger urban areas generally having earlier mapping near their historic downtowns, and smaller towns and more peripheral urban areas having later mapping. The purpose of this review was to evaluate the potential for subsurface remains related to the historic period of occupation, as opposed to an effort to identify whether properties depicted in the Sanborn maps are extant within the APE. Fresno, Wasco, Shafter, and Bakersfield all partially intersect the APE and include buildings or structures that were once within the APE. The other towns, while in proximity to the APE, do not include mapped structures within the APE. This review did not immediately identify elements of infrastructure that would predict the existence of a subsurface historic-period deposit, such as a privy.

Historic period archaeological property types that may be encountered within the APE for a given location and time period, based on the structures depicted include properties associated with transportation (primarily railroad related) water conveyance, industrial facilities, commercial enterprises, and residences. However, it should be noted that no features of the Sanborn-

mapped streetscapes indicate the presence of potential sources of historic-period deposits or structural remains within the APE.

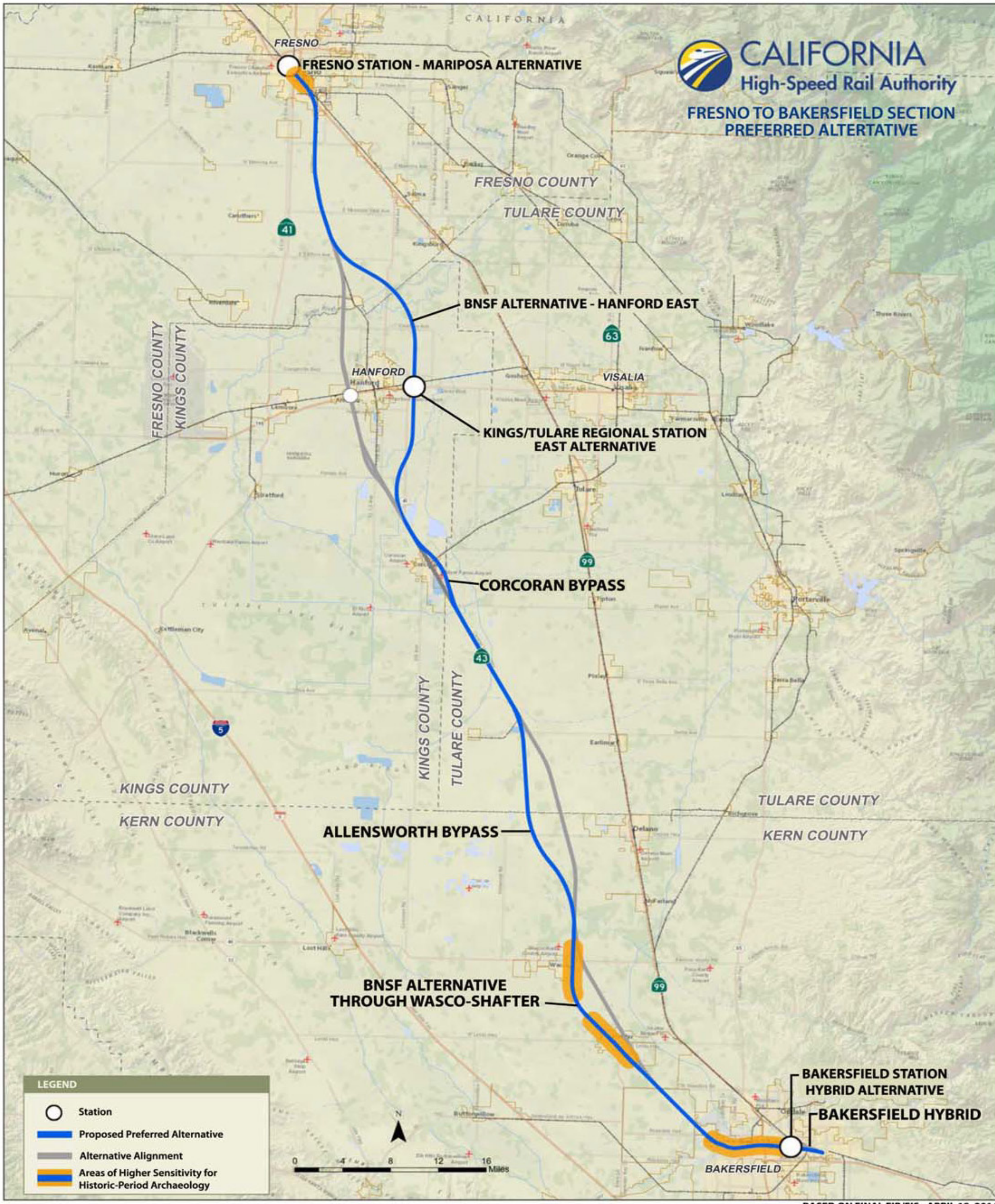

Figure 5.1 Sensitivity for Historic-Period Archaeology (highlighted in orange)

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6.0 Significance Criteria for Archaeological Resources

6.1 Federal Criteria (Section 106 of the NHPA)

NEPA and NHPA require federal agencies to consider the effect of their undertakings on significant resources, designated as "historic properties." The significance of an archaeological site or an architectural resource in terms of NEPA and NHPA is defined in terms of the criteria for listing in the National Register of Historic Places (NRHP). These criteria, defined in 36 CFR § 60.4, state that a resource must be at least 50 years old (unless meeting exceptional criteria) and possess the quality of significance in American history, architecture, archaeology, engineering, and culture and is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

A. Is associated with events that have made a significant contribution to the broad patterns of history;

B. Is associated with the lives of persons significant in the past;

C. Embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction; or

D. Has yielded, or may be likely to yield, information important in prehistory or history.

If a particular resource meets one or more of these criteria and retains integrity, it is considered eligible for listing in the NRHP and is therefore treated as an "historic property" under Section 106 of the NHPA.

6.2 State Criteria (CEQA)

The California Environmental Quality Act (CEQA) is a statute under California state law that, among other requirements, requires state and local agencies to identify the significant environmental impacts of their actions on "historical resources" and to avoid or mitigate those impacts, if feasible. Although the criteria for significance under CEQA are broadly similar to the federal NRHP criteria, they are more inclusive, and also more complex in terms of how they define the significance of resources. Under CEQA, "historical resources" are resources that meet any of the three following criteria:

1. are listed in, or determined eligible for listing in, the California Register of Historical Resources (CRHR); or
2. are included in a local register of historic resources that meets certain standards; or
3. have been determined historically significant by a lead agency as supported by substantial evidence in light of the whole record (CCR Title 14, Section 15064.5 [a]).

The most commonly used of these three criteria for determining significance under CEQA is evaluation of resources for the CRHR. The standards for eligibility for the CRHR are modeled after the criteria for listing in the NRHP, and are as follows:

1. Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.
2. Is associated with the lives of persons important in our past.

3. Embodies the distinctive characteristics of a type, period, region, or method of construction; represents the work of an important creative individual; or possesses high artistic values.
4. Has yielded, or may be likely to yield, information important in prehistory or history.

6.3 "CEQA-Only" Cultural Resources

In practice, any resource that is eligible for listing in the NRHP is automatically considered eligible for listing in the CRHR and is therefore an historical resource for the purposes of CEQA. However, resources found eligible for the CRHR are not considered to be automatically eligible for NRHP listing, and frequently do not meet the more stringent standards of the NRHP criteria. In addition, resources considered to be historical resources for the purposes of CEQA occasionally do not meet any of the four criteria listed above for CRHR listing (this typically occurs in the context of building surveys undertaken for a local [city] register of historic resources). This asymmetry between the federal and state significance criteria results in a category of cultural resources eligible under CEQA but not Section 106. For the purposes of the HST Project, these have been designated as "CEQA-only cultural resources" (Authority 2013). The Fresno to Bakersfield Section of the HST Project has several "CEQA-only" built environment resources which have to be treated under CEQA (Authority and FRA 2014c), but no "CEQA-only" archaeological resources. Archaeological "CEQA-only" resources are extremely rare, and it is anticipated that none will be identified within the Fresno to Bakersfield Section of the HST Project.

7.0 Research Framework – Prehistoric Archaeology

To apply NRHP or CRHP significance criteria to an archaeological site, it is necessary to develop a framework that identifies current regional research issues that can be addressed through implementation of an evaluation program and, as appropriate, through data recovery. The framework outlined below is general in nature and as such is intended to provide an evaluative construct only for the evaluation of known resources. Fully expanded research designs must await completion of the identification archaeological resources within the APE, when a fuller understanding of applicable research avenues would be possible. Site-specific research designs will conform to the ATP requirements outlined in Sections 9.4, 9.5, 9.6, 10.1, 13.1, and 13.2.

Research topics applicable to known resources include:

- Chronology
- Site structure and formation processes
- Subsistence and settlement
- Trade and travel
- Lithic technology and toolstone procurement
- Ethnography and proto-historic occupation

7.1 Chronology

One of the most important prehistoric research goals in the Central Valley is the refinement of regional chronological frameworks. Due to the relative paucity of sites investigated in the area and the reliance on archaeological research conducted primarily over 50 years ago, research that might yield chronometric information can make a valuable contribution to the archaeological record of the area. Research at sites in the APE also has the potential to reveal information about the very early occupation of the region as some of the oldest artifacts in the state have been found on the shores of Tulare Lake. These artifacts—including fluted spear points and an associated blade technology—have been dated to the end of the last ice age 13,500-11,500 years ago, shortly after glaciers had receded from much of North America.

Therefore, sites in the project area that contain diagnostic artifacts (e.g., projectile points, ornaments such as beads and artifacts made of obsidian) and archaeological remains that can be radiometrically dated could provide an opportunity to verify and expand the known parameters of cultural patterns currently defined in the Central Valley.

Buried sites more often contain and preserve materials that are suitable for radiometric dating, particularly given that surface contexts in the APE have been heavily disturbed by agricultural activities. A site that contains organic cultural remains that are suitable for radiocarbon dating could help refine the regional chronological framework. The discovery and radiometric dating of archaeological deposits in the study area, particularly deposits from the Paleo-Indian, Early Archaic, and early Middle Archaic periods, would provide important new information to the archaeological record in the Central Valley.

Within the project area, the following chronology-associated datasets may be relevant to establishing temporal affiliation:

- Presence of organic materials suitable for radiocarbon dating – Radiocarbon dating remains the most reliable chronometric tool available. The presence of suitable organic material substantially increases a site's research value.
- Presence of stratified or deeply buried deposits – Stratified cultural deposits, which are useful in developing regional chronological sequences, are relatively rare near the study area. Habitation site deposits may be expected to be discovered in buried circumstances,

resulting in the potential for stratigraphic separation between occupation periods and definition of a relative chronology based on artifact assemblages.

- Presence of typable projectile points, other formal tools, and ornaments – Cross dating of point types through associated radiocarbon dates and directly through obsidian hydration dating can help verify the temporal utility of point types. Shell and stone beads and ornaments have definitive temporal associations that can be utilized to associate sites with particular time periods and cultural patterns (Gifford 1947; Bennyhoff and Hughes 1987; King 1990; Hughes and Millikan 2007).
- Presence of obsidian suitable for hydration dating – The considerable presence of obsidian in the archaeological record in the Central Valley indicates a substantial trade for obsidian from sources in the North Coast Ranges, such as Borax Lake and the northern Napa Valley, and east of the Sierra Nevada Mountains, in the western Great Basin. In the San Joaquin Valley, sources in the western Great Basin such as Bodie Hills, Casa Diablo, and Coso have predominated during the Middle and Upper Archaic and into the Emergent period (Sutton and DesLauriers 2002; Rosenthal et al. 2007). Although sources in the North Coast Ranges (Clark 1961; Fredrickson and Origer 2002) and western Great Basin (Singer and Ericson 1977; Mone and Adams 1988) have been extensively studied, the Coso obsidian source has been intensively studied for hydration-dating purposes (Gilreath and Hildebrandt 1997; Rogers 2006). Despite numerous problems, obsidian hydration analysis from each of these sources, but particularly from Coso sources, has been generally successful in producing results accurate enough for chronological ordering (seriation) and placement of assemblages within a reliable range of dates.

7.2 Site Structure and Formation Processes

In the San Joaquin Valley, abundant evidence for human occupation has been encountered for the late Middle Archaic, Upper Archaic, and Emergent periods along the margins of the valley and along rivers, ancient lake shores, and sloughs. In many areas there is a gap in the early archaeological record which was suspected to be principally the result of natural depositional conditions and erosional forces that have buried or destroyed evidence of human occupation during earlier periods. Additionally, it is likely that the substantial amount of agricultural activity in the area has damaged or destroyed many resources.

The area around Tulare Lake is an anomaly in that Late Pleistocene/Early Holocene cultural deposits found indicate that forms of large hunting-related tools characterized the assemblage (Hartzell 1992:317–331; Siefkin 1999:50). Also noted with these artifacts were species of extinct megafauna, although direct cultural association has not been proven in California (Siefkin 1999:49).

Geoarchaeological research performed for the project (Authority and FRA 2014d) provides the basis for assessing the sensitivity and potential for buried prehistoric archaeological resources within the APE (Figure 4.2). The importance of predicting buried archaeological sites within the Fresno to Bakersfield HST project area is heightened by the lack of intact surface sites. Given the large areas of Holocene sedimentation and highly dynamic alluvial environment demonstrated in the initial geoarchaeological investigation of the Fresno to Bakersfield HST project area, it is difficult to anticipate precisely where buried archaeological resources will be located. The excavations generally support the sensitivity model developed by Meyer and others (Meyer et al. 2010). There appears to be strong variability in the preservation potential within the highly sensitive areas investigated due to the presence of numerous abandoned channels (both major and minor) associated with the various drainages. This same variability is represented in numerous paleosols observed and dated.

The accretion of alluvial sediment within the alluvial fan and basin landforms investigated for this project (Authority and FRA 2014b) appears to be much less than anticipated. In a synopsis of San Joaquin Valley archaeology, Riddell (2002:56) surmised that the valley, prior to the historic impounding of waterways, received an average accretion of from 1 to 1.5 meters of alluvium each millennium; thus increasing the likelihood of preservation of buried archaeological sites. However, the stratigraphic profiles and dating reported in the Geoarchaeological Investigations Report (Authority and FRA 2014b) indicate that, adjacent to Tulare Lake, middle-Holocene soils are buried on the order of only 1 meter below the current ground surface, and Pleistocene soils at 2 to 3 meters -- much less than suggested by Riddell. Within the portion of the Kings River fan that was investigated, north of Hanford, average deposition rates appear to be approximately twice as much, with middle-Holocene soils buried on the order of 2 to 3 meters below surface. Functionally, these results suggest that buried archaeological sites, if present, along the area fronting Tulare Lake, will be on average at shallower depths than other locations further up the Kings River alluvial fan. Further geoarchaeological studies combined with testing and data recovery excavations have the potential to address the current gap in the archaeological record.

7.3 Settlement and Subsistence Patterns during the Late Holocene

Out of necessity, archaeological research on prehistoric settlement and subsistence patterns in the Central Valley has focused on the Upper Archaic and the Emergent periods because relatively little information exists for the Paleo-Indian and the Lower and early Middle Archaic periods. Although fluted projectile points, blade tools and cores, and other artifact types indicative of Paleo-Indian occupation have been found around the Tulare Lake Basin and in a few other isolated locations in the Central Valley, the Tulare Lake materials are the only finds with an identifiable context. The Witt site (CA-KIN-32), on the western edge of Tulare Lake, is the most well documented of these Paleo-Indian and Lower Archaic sites. The Tulare Lake context is consistent with the presence of these points at other Paleo-Indian/Lower Archaic, Late Pleistocene/Early Holocene pluvial lakes in the Mojave Desert. Fluted points are commonly assigned to the Big Game Hunting Tradition of the Paleo-Indian period, which is associated with a subsistence focus on large game animals (megafauna) that were still present in the area during this early time period. After the Paleo-Indian period, the archaeological record in the Central Valley becomes even sparser. As previously indicated, evidence of human occupation in the Early Holocene, during the Lower Archaic, consists mostly of a few surface finds of items such as stemmed projectile points and flaked crescents; most of these occur around the lake basins in the southern San Joaquin Valley. The only archaeological deposit radiometrically dated to this period was also associated with these lake basins and was identified in deeply buried soil along the ancient shoreline of Buena Vista Lake at CA-KER-116. This deposit produced three flaked crescents and radiocarbon dates on freshwater mussel shell of between 7,175 and 6,450 cal B.C. (Fredrickson and Grossman 1977; Rosenthal et al. 2007: 151). Also, as previously indicated, the gap in the archaeological record in the valley spanning from the Paleo-Indian to the middle of the Middle Archaic has largely precluded analysis of settlement and subsistence practices during these earlier periods.

Because the substantive archaeological record for the San Joaquin Valley extends back only about 5,000 years to the late Middle Archaic (only being robust extending back about 2,500 years to the end of the Middle Archaic), studies of settlement and subsistence practices have focused on the Upper Archaic and Emergent periods. Recent studies of settlement and subsistence practices have concentrated on attempting to explain apparent archaeological evidence for a rapid and continuous increase in population beginning in the Upper Archaic and extending through the Emergent period. By 1980, according to Rosenthal et al. (2007: 159), "a growing radiocarbon database demonstrated that sites more than 2,500 years old were rare in the Central Valley, which was interpreted as evidence for a sharp increase in human population during the

Upper Archaic…." Accompanying this was a realization "that the devices associated with pursuit and processing of ethnographic staples (e.g., the mortar and pestle related to acorn processing and net weights, spears, and hooks needed for fishing) were relatively recent innovations that came into widespread use only after 2,500 years ago…" (Rosenthal 2007: 159).

Consequently, to explain this apparently rapid increase in population beginning in the Upper Archaic period, studies of settlement and subsistence practices during the last 25 years have concentrated on attempting, through theoretical concepts such as intensification, demographic forcing, optimality, and resource depression, to analyze and better explain the changes apparent in the archaeological record during this period (Rosenthal et al. 2007). The concepts of resource intensification and demographic forcing were based largely on a precept by Cohen (1981; cited in Rosenthal et al. 2007), which theorized that prehistoric diets during the late prehistoric were less efficient and balanced than in earlier times and that high energy cost foods such as acorns (a foodstuff substantially in use in the Central Valley beginning during the Upper Archaic) were not a facilitator for larger population but a requirement to accommodate larger populations.

Basgall (1987) added to the concept of demographic forcing by expanding the possible causes for an imbalance of available food resources and population to include in-migration of new populations, food resource depletion due to human over-exploitation, and reduced resource productivity due to climate change. Wohlgemuth (1996) examined archaeobotanical data from Central California sites, some in areas of the Central Valley, and suggested that a possible example of resource intensification occurring during the Emergent period was a shift, noted in the botanical assemblages, to a more diversified vegetal diet that included seeds and acorns to broaden the resource base to accommodate larger populations in the area (also see Bettinger 2008: 159−163).

Patterns of mobility are also of research interest in the study of prehistoric settlement and subsistence practices. Because there appear to be more sites in the archaeological record dating to the Upper Archaic and Emergent periods than to the Middle or Lower Archaic, it is generally interpreted that population density in the valley was increasing during these later periods. With a smaller population drawing on them, it can be hypothesized that subsistence resources would be more abundant during the earlier periods; with fewer people competing, these earlier, smaller populations would also be able to select those resources with the highest caloric return. Smaller populations would also allow for greater mobility over a larger territory and they would, therefore, be able to travel to and procure high-yield resources from more distant locations.

Bettinger (1991; 2001) has observed that this "traveler" strategy is characteristic of most Early and Middle Holocene hunter-gathers worldwide, and it appears reasonable to hypothesize this for the Lower and Middle Archaic in the Central Valley. By the end of the Emergent period, however, the situation was different with relatively large populations facing likely greatly reduced procurement territories and a consequential need to intensify resource usage within this reduced procurement area (Binford 1980). The mobility of the foraging group would likely be reduced because of surrounding population pressures. This more limited mobility would likely induce a different subsistence strategy, labeled by Bettinger (1991, 2001) as a "processor strategy" resulting from diminishing search time, increasing processing time, and the need for using lower quality resource patches. The archaeological record in the southern San Joaquin Valley is currently inadequate to allow analysis to identify or verify such possible shifts in patterns of prehistoric mobility in the area.

7.4 Trade

Using archaeological evidence for the movement of goods across the landscape, researchers seek to understand the networks that people used to gain, barter for, purchase, or otherwise obtain raw material, goods, and services from the producers or sources. These networks of exchange

are identified by using a variety of analytical techniques on material culture, and by identifying raw material quarries and manufacturing techniques for specific types of artifacts. Exchange systems are also the way ideas and innovations are communicated across the landscape.

Shell ornaments obtained from coastal groups and obsidian from groups in the northwest coastal mountains and the western Great Basin (Davis 1961; Bennyhoff and Hughes 1987; Moratto 1984; Hughes and Milliken 2007) provide abundant evidence for trade of the Central Valley, even extending back to the Lower Archaic period. According to Rosenthal and others, "Regional interaction spheres appear to have been well established in the Lower Archaic…" (2007: 152), and "Exchange of commodities such as obsidian, shell beads and ornaments as well as perhaps other perishable items, was widespread during the Middle Archaic" (2007: 155). Trade for these items continued and flourished into the Upper Archaic and Emergent periods. Obsidian, in particular, was a desired commodity, being procured from both the North Coast Ranges and sources on the east side of the Sierra Nevada Mountains and western Great Basin. Interestingly, during the Upper Archaic, the obsidian recovered at sites in the San Joaquin Valley was derived mostly from sources on the east side of the Sierra in the western Great Basin, such as Bodie Hills, Casa Diablo, and Coso. Sites in the Sacramento Valley reflect trade mostly with sources in the North Coast Ranges, such Borax Lake and northern Napa Valley (Sutton and DesLauriers 2002; Rosenthal et al. 2007). Identification of archaeological assemblages within the project area that contain exotic materials (e.g., obsidian, shell) as well as evidence of manufacture of goods for trade (e.g., lacustrine resources, beads, charmstones) may be relevant to further demonstrating and quantifying patterns and changes in trade networks through time.

7.5 Lithic Technology and Toolstone Procurement

A great deal of research has focused in recent years on the relationship between stone tools and human organizational strategies. Of special interest has been the process of tool production with an emphasis on raw material procurement, manufacturing techniques, and tool maintenance processes as they relate to adaptive strategies of toolmakers and users.

Research topics that explore lithic technology and toolstone procurement often overlap into those outlined for trade, especially in places like the Central Valley where the valley floor is dominated by fine-grain sediments and there are few potential sources of lithic raw material (Hintzman 2003). Most local toolstone sources consist of cobble/gravel sedimentary formations containing cobbles of chert and volcanic or metavolcanic materials (Treganza 1952), as well as cobbles of quartzite and quartz (Hintzman 2003). As stated by Rosenthal and others (2007), in regard to materials used in the manufacture of projectile points during the Middle Archaic: "Source materials are also variable, owing to a reliance on local toolstone supplemented by a small percentage of obsidian derived from the nearest quarries in the North Coast Ranges, Cascades, and the eastern Sierra." The adjacent coastal mountains on the west side of the San Joaquin Valley were also a possible source for raw materials, such as Franciscan and Monterey cherts that could have been obtained by travel or trade.

7.6 Ethnography and Protohistoric Occupation

Several ethnographic Yokuts village sites have been recorded in the vicinity of the project area, including Yimel, Wititsolowin, and Yiwomni—near the eastern shore of Tulare Lake—and Woilu near Bakersfield (Wallace 1978). No archaeological evidence for the Tulare Lake villages has been reported. CA-KER-2507 is the reported location of a major Yokuts Yowlumne ethnographic village known as Woilu. Although reportedly destroyed by subsequent historic period development, and absent in prior test excavations in the area, it is possible that portions of the site could remain intact buried beneath the development. If intact ethnographic-period

archaeological deposits are present in the project area, excavation and analysis could present a unique opportunity to learn about a little known time in the Yokuts history and their contact with Euroamericans.

8.0 Research Framework – Historic-Period Archaeology

Similar to prehistoric resources, the evaluation of historic-period archaeological resources in accordance with the CRHR and NRHP requires the development of research frameworks to guide significance assessments and data recovery, as appropriate. Research frameworks for historic-period archaeological resources tend to be more site-specific than for those developed for prehistoric resources because an historic site's significance is typically tied to its association with persons, activities, or events.

Because only 30 percent of the APE has been inventoried for archaeological resources and there are no known historic-period sites in the APE, developing site-specific research domains is not possible at this time. Historic research conducted to date for the undertaking has revealed that the overall sensitivity of the APE is low for historic-period archaeological resources because the alignment generally follows an existing freight rail line or extends across vast tracks of vacant agricultural land.

Nonetheless, predictions can be made for historic-period archaeological site types to occur within the APE, including: residential, commercial, and industrial resources associated with cities and towns; resources associated with agricultural activities; and transportation-related resources. Table 8.1 shows the property types that could be encountered, including the features and their typical attributes. Figure 5.1 shows the areas where historic-period archaeological resources could be present.

The APE includes the southern limits of Fresno and extends into the downtown area of Bakersfield, with the route generally following the BNSF Railway freight tracks that run between the two cities through rural Fresno, Kings, Tulare and Kern counties. The route includes a bypass that veers from the freight railroad by sweeping eastward around the city of Hanford and takes shorter bypasses to avoid the communities of Corcoran and Allensworth. The route follows the BNSF tracks through the cities of Wasco and Shafter.

The following provides a general research framework to guide additional historic property identification as it relates to historic-period archaeological properties. In the event that historic-period archaeological sites that require evaluation are encountered during the inventory phase, site-specific research designs will be prepared in conformance with the requirements outlined in Sections 13.1 and 13.2. Specifically, if historic period archaeological resources are identified or predicted to be present in the APE, work will be conducted in accordance with Sections 9.4 and 9.6 to determine if surface or subsurface deposits or features have the morphological integrity and the data potential to address relevant research questions. This will be determined by assessing each resource's data potential in terms of the capacity to address the research themes and questions identified in site specific research designs as outlined in Sections 8.1 – 8.3, below. This assessment process will determine whether resources encountered during archaeological testing have the data potential to address important research questions and whether they retain sufficient integrity to convey that significance. Site-specific research designs will outline how archaeological deposits must be in their original location, retain deposition integrity, contain adequate quantities and types of materials in suitable condition to address important research topics, and have a clear association.

8.1 Residential, Commercial and Industrial-Related Properties

Because the towns and settlements along the Fresno to Bakersfield alignment were developed after (and as a result of) the railroad, as opposed to cutting through neighborhoods, the potential for the actual railroad alignment to intersect with residential, commercial or industrial-related

properties deposits remains low. Still, within the cities, there is a relatively high need to relocate utilities to accommodate the HST project. These utility relocations can extend into areas with medium to high potential for residential, commercial or industrial-related properties, deposits, and structural remains.

Research domains that encompass residential, commercial or industrial related properties would be quite diverse and include questions regarding urban expansion as related to the railroad; socioeconomic variability, including social and economic stratification; consumerism; ethnicity; and the development of industrialization and technological advancements.

8.2 Agriculture-Related Properties

Where the Fresno to Bakersfield Section leaves the BNSF corridor it will be constructed primarily within areas that are currently agricultural. For the most part, these areas are comprised of very large landholdings with limited numbers of residences, outbuildings, and agricultural facilities. This has been true throughout the history of the area, which greatly reduces the potential to encounter former farms or residences in significant numbers.

Agriculture-related resources would likely consist of archaeological deposits and structural remains associated with residences, as well as other structures and facilities found on farms and ranches such as barns, outbuildings, wells, and outhouses/privies. Intact deposits and features that could be associated with events or individuals significant in the agricultural history of the region could address issues and questions centered around the development of farming and ranching practices in the Central Valley, comparisons between different ethnic groups engaging in agriculture, and the socioeconomic variability, including social and economic stratification of farming and ranching families.

8.3 Transportation-Related Properties

Archaeological resources associated with transportation are likely to be limited to railroad-related resources, which are typically identified at existing and former station locations, depots, and sidings. The Fresno to Bakersfield Section of the HST parallels railroads including the Atchison, Topeka and Santa Fe (AT&SF) line (now owned by BNSF) and the Southern Pacific Railroad (now owned by UPRR). Within the Fresno to Bakersfield Section, many smaller rail systems and branch and spur lines that feed into the main lines of the major railroad routes also parallel or cross the APE.

These railroad companies platted towns and established stations that spawned communities, including Fresno and Hanford (both established by Southern Pacific) and the AT&SF cities of Wasco and Shafter. The Fresno to Bakersfield Section of HST along the BNSF is largely west of the original Southern Pacific alignment, but few of these Southern Pacific towns are within the APE except the city of Fresno and the community of Sumner (now called "East Bakersfield").

The BNSF owns the former AT&SF line between Fresno and Bakersfield and mainline improvements have included upgrades to its roadbed and replacement of most engineering features from its original construction in the 1890s. Specifically all of the rail ties and ballast in this part of the system were installed from the 1970s through the 1990s, or even more recently, indicating that historic features of the railroad are unlikely to be identified.

The AT&SF did not invest in town development the way that the Southern Pacific had, and instead private interests started small town sites adjacent to the AT&SF line near depots and sidings. These include Angiola, Guernsey, Spa, Blanco, and Turnbull. Angiola, for example, had a post office but is currently only marked by a few structures and grain silos. Examination of aerial photography suggests that little remains of Guernsey, Blanco, Spa and Turnbull beyond

being place names on a map. Nonetheless, deposits could be present with the APE related to the occupation or use of these locations.

More promising is the possibility for railroad-related archaeological deposits or possibly structural remains associated with railroad facilities in the towns of Fresno, Bakersfield, Wasco and Shafter. While the potential for encountering such deposits still remains low because these towns and settlements were developed after and as a result of the railroad (rather than the railroad cutting through existing neighborhoods), intact deposits or structural remains could be identified in areas requiring utilities relocation.

Archaeological deposits could potentially be located along the railroad like the former location of Stoil, a resource within the APE that was found ineligible for the CRHR and NRHP due to lack of integrity but typifies the type of railroad related resources likely to be identified in the APE. Stoil (a name compounded of "Standard Oil") was a depot and oil pumping facility along the Santa Fe rail line, operated by Standard Oil Company (Gudde 1998). Archaeological remains consist of a sparse, widely dispersed scatter of historic-era (late nineteenth and early twentieth century) domestic debris adjacent to the eastern side of the BNSF Railway tracks. Surface artifacts and features represented the remnants of a home site, as the debris is characterized by concrete and brick structural elements and ceramic sewer pipe.

If such deposits and remains at these locations could be associated with significant events in the history of the railroad in the Central Valley, research domains could include issues of technological improvements and innovation for the railroad as well as railroad support facilities, consumer preference and behavior exhibited by railroad passengers and/or personnel, as well as the related topic of difference in social and economic status of individuals associated with the railroad. It is also possible that railroad construction camps could be identified within the APE. If intact deposits were identified that could be associated with railroad construction, additional questions could be addressed centered around worker ethnicity as related to social and economic status, and questions of how a transitory lifestyle are reflected in consumer behavior and preferences.

Table 8.1 Historical Archaeology Property Types

Property Type	Feature Type	Attributes
Refuse	Hollow-filled features (pits, privies, and/or wells)—these may be associated with domestic sites, retail stores, hotels, boardinghouses, and saloons	Discrete Deposits
	Sheet Refuse (Ephemeral vs. Massive)	Thin layer of refuse that may have accumulated over time vs. Large discrete layer of refuse representing one event
Architecture	Foundations	Brick alignments, concrete slabs, piers
	Builder's trenches	Concrete, brick, or wooden, in situ or collapsed
	Walls/ Floors	Concrete, wooden, or tile
Agriculture and Landscape	Fences	Postholes in alignment
	Gardens	Tree pits, decorative elements
Urban Infrastructure	Water/Sewer Pipes Power Lines	Pipes, Post Holes
	Fill	Gravel, non-native soils
	Roads	Asphalt, paving stones
Industrial	Manufacturing	Industrial by-products
	Packing Plant	Industrial by-products

9.0 Plan for Completion of Historic Property Inventory Efforts for Archaeological Resources

9.1 Background

According to PA Stipulation VI.E ("Phased Identification"), phased identification of historic properties may occur in situations where the identification of historic properties cannot be completed prior to project approval. As discussed above, the archaeological inventory has been limited to approximately 30 percent of the archaeological APE for this undertaking, due to lack of permissions to enter private properties. For this reason, the Contractor will be responsible for completing the identification efforts prior to construction for the portions of the APE that have not yet been investigated. Attachment A shows the APE for CP 1C and CP 2/3 as well as the areas that have been surveyed and areas still requiring survey.

In addition, given the current stage of the design process, finalization of the project design by the Contractor may result in modifications to the existing APE, which could, in turn, encompass new parcels for which the Contractor would need to conduct additional archaeological investigations. Documentation of these pre-construction historic property identification efforts will be provided in supplemental Archaeological Survey Reports (sASRs), and resource evaluation efforts will be documented in Archaeological Evaluation Reports (AERs) or Combined Archaeological Evaluation and Data Recovery Report (CAEDRR), which are described in Sections 9.6 and 13.2. If additional TCPs are encountered, they will be documented and evaluated in stand-alone studies (e.g., Authority and FRA 2013f) that comply with *National Register Bulletin 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties* (National Park Service 1998). This section describes the methods to be employed to complete the historic properties identification for the Undertaking and includes the following efforts:

- updated records and literature research for the final APE, as well as a half-mile buffer;
- pedestrian archaeological surveys of as-yet unsurveyed parcels within the final APE;
- archaeological site recordation;
- geoarchaeological studies;
- development of a Final Archaeological Sensitivity Map(s);
- preparation of final/supplemental treatment plans;
- archaeological test excavations including site eligibility recommendations;
- data recovery excavations;
- laboratory analyses of any cultural materials recovered;
- report preparation on the results of the surveys, testing and data recovery excavations;
- MOA signatory and concurring party review and SHPO review and concurrence; and
- of any archaeological materials recovered as a result of the excavations.

For the Fresno to Bakersfield Section, the first area to be constructed will be Construction Package 1C (CP 1C), which is located in the southeastern portion of the City of Fresno. The next area (CP 2/3) will extend approximately 60 miles through the Central Valley, beginning at East American Avenue in Fresno and continuing south to approximately one mile north of the Tulare-Kern County. Finally, CP 4 will extend the alignment to 7th Standard Road north of Bakersfield (Figure 2.2).

All pre-construction cultural resources commitments (see Section 10.1) must be met prior to ground-disturbance in any given area of the Undertaking. The timing of additional identification efforts and reporting will depend on a number of factors, including: completion of the project design; the contractor's schedules and priorities for construction; and the timing of parcel access. It is anticipated that property access for the purposes of archaeological survey will be obtained on a parcel-by-parcel basis, with the first access being obtained for CP 1C following by CP 2/3 and then CP 4. Consequently, multiple supplemental ASRs may be produced and submitted for signatory and concurring party review as each construction package within the segment is completed. Due to the parcel-by-parcel access, completing commitments and obtaining SHPO concurrence will likely occur at intervals, in a patchwork fashion, with work proceeding in some areas while other areas will remain uninvestigated, pending access. A final supplemental ASR synthesizing the results of the identification effort will be produced once all field surveys have been completed for the entire Fresno to Bakersfield Section.

To accommodate the Design-Build process, it is anticipated that final supplemental treatment plans will be prepared for each of the two construction packages at the conclusion of the design process. These final supplemental treatment plans will reexamine the treatments recommended in the original treatment plans and review final design to ensure that all properties adversely affected are addressed and that treatments are appropriate for the impacts that will result from the final design. Preliminary draft final supplemental treatment plans will be provided to FRA by the Authority for a 14-day review period. Following FRA review and revision, the Authority shall provide draft final supplemental treatment plans to the MOA signatories for a 30-day review and comment period. Based on the comments received, the Authority will revise and submit the treatment plans to the MOA signatories for a final 30-day review. The Authority shall ensure that comments received as a result of this consultation process will be considered prior to finalizing the final supplemental treatment plans.

It is anticipated that a final supplemental treatment plan will, at a minimum, be prepared for each of the construction packages; however, it may be necessary to prepare several final supplemental treatment plans in order to facilitate construction in certain areas or for specific activities, while the design for other areas or work is finalized later.

9.2 Revising and Finalizing Area of Potential Effect

The Contractor will be responsible for ensuring that the final project design is reflected in the APE and that the cultural resources investigations described herein have been conducted accordingly. Both the PA and MOA outline the review and approval process that must be followed when APE modifications become known. Following completion of the design process, the Archaeological APE will be finalized in accordance with the requirements of PA Stipulation VI.A and MOA Stipulation II. The process could occur in phases resulting from prioritization of areas for construction. As the APE, or portions thereof, is revised, maps will be produced showing the modified APE as compared with the original APE. The revised maps will be provided to the AR for circulation to the MOA signatories for a 15-day review. Following this review, the CRCM and the AR will determine what additional inventory or evaluation work is required for the new APE and will direct the Contractor to complete that work.

9.3 Determination of Areas of Archaeological Sensitivity

The entire APE between Fresno and Bakersfield has been preliminarily assessed for potential archaeological sensitivity based on literature research, historical research, pedestrian survey, input from consulting party tribes, and geoarchaeological investigations. Earlier sections describe the results of the literature and historical review, inventory, and the geoarchaeological research.

9.3.1 Prehistoric Archaeological Sensitivity

Areas of prehistoric archaeological sensitivity are depicted in Figure 4.2, which, among other sources, will be used to inform the production of sensitivity mapping and the Archaeological Monitoring Plans. Areas in Figure 4.2 are ranked from low to high based on predicted sensitivity based on professional archaeological and geoarchaeological investigations conducted for the Undertaking, and consideration of factors such as proximity to known sites and/or natural waterways where prehistoric activities or settlements typically occur and where buried paleosols and possibly buried sites are predicted to occur. Information received from Native Americans also seems to fit this model, especially in regards to the presence of sensitive areas in the vicinity of former Tulare Lake. While the sensitivity mapping will be further refined in the future, it is anticipated that soil-disturbing activities will be monitored in all areas designated as "high" or "very high" in Figure 4.2.

As the historic properties identification effort is completed by the Contractor, modifications and/or additions to the prehistoric archaeological sensitivity mapping by the Contractor may be necessary, depending on the results of the inventory effort. These areas of sensitivity form the basis of establishing the archaeological and Native American monitoring requirements in the monitoring plan described in Sections 10.1.5 and 10.2.1. These maps can be revised and submitted by the Contractor for approval by the AR in phases based on inventory and construction priorities.

9.3.2 Historic-Period Archaeological Sensitivity

Areas of sensitivity for historic-period archaeological resources, as depicted in Figure 5.1, have been determined primarily through literature searches and archival and historical research.

It is not anticipated that additional sensitive areas will be identified, but as the historic properties identification effort is completed by the Contractor, modifications and/or additions to the historic-period archaeological sensitivity map by the Contractor may be necessary, depending on the results of the inventory effort. These areas of sensitivity contribute to the development of the monitoring requirements in the monitoring plan described in Sections 10.1.5 and 10.2.1. These maps can be revised and submitted by the Contractor for approval to the AR in phases based on inventory and construction priorities.

9.4 Inventory

Approximately 70% (3000 acres) of the APE has not been surveyed due to lack of legal parcel access. Attachment A depicts the areas within the APE for CP 1C and CP 2/3 where pedestrian field surveys have and have not yet been completed. As required by PA Stipulation VI.E, prior to ground disturbing construction activities, the remaining unsurveyed portions of the APE for the project will be subject to a post-review identification and evaluation effort in accordance with this ATP. The schedule for these surveys will be dependent upon the timing of obtaining legal access to the properties, and in many areas will be driven by the need to complete construction-related activities (e.g., geotech borings, laydown yards, etc.).

Prior to beginning inventory work, a records search will be updated to ensure that the most accurate information is obtained regarding previous inventory and evaluation efforts. If completion of the design process results in additions to the APE that require pedestrian survey, it may also be necessary to conduct new records searches and documentary research into the prehistory or history of the new APE areas.

The archaeological field team or teams will be led by the PI. In general, the archaeological field team will investigate the accessible areas within the APE by walking parallel transects generally

spaced no more than 15 meters (49.2 feet) apart, periodically zigzagging between transects. Field survey methods will be determined by surface conditions, ground surface visibility across the APE, and will take into consideration vegetation cover and urban development (e.g., paving). Areas of dense underbrush and heavy crop cover will be spot checked or sampled to the degree possible (i.e., examining dirt from rodent burrows and walking between underbrush clusters rather than on parallel transects when dense vegetation requires substantial clearing to expose transects). Paved or submerged locations will not be surveyed, except at their margins. Survey conditions, methodologies, and rationales must be clearly described and documented in the sASR.

The survey crew(s) will use large-scale aerial maps or map books that depict the APE and landscape features to aid in identification of the APE boundaries. The field team will also use global positioning system (GPS) units with the same mapping in its database to provide additional assistance in identifying the APE in areas where fewer visual checkpoints exist to check that the survey is being conducted within the proper corridor.

If the APE encroaches within 25 feet of the railroad centerline, the APE will be examined from the adjacent parcels because railroad regulations prohibit encroachment within 25 feet of the track. Most of this zone is generally covered by ballast and surface soils are not visible.

All portions of the APE not surveyed (e.g., because they are paved, submerged, covered in dense vegetation, or are within railroad ROW) will be delineated on survey coverage maps to be included in the sASRs. Information on the levels of survey intensity for each parcel will be described in the sASRs and depicted on the survey coverage maps. The acreage and percentage of areas surveyed and not surveyed will be included in the sASRs.

The archaeological field team(s) will revisit sites previously documented within or immediately adjacent to the APE, comparing the currently visible manifestations of these sites with information previously recorded on California Department of Parks and Recreation (DPR) forms. The updated site information will be documented on continuation sheets (form DPR 523). Newly identified resources will be recorded on the appropriate DPR forms in accordance with Office of Historic Preservation Guidelines. Recordation of resources identified in the APE should not be limited to the APE. Archaeological site boundaries should be recorded to the maximum extent feasible within the parcels with permission to enter.

In archaeologically sensitive areas where vegetation cover prevents an effective surface survey, Extended Phase 1 (XPI) investigations may be conducted. Reasons to conduct an XPI study include the following:

- To determine whether a portion of a known site extends into the APE.
- To search for archaeological deposits (as an extension of the survey effort) in areas of high sensitivity where surface manifestations may be buried or obscured by vegetation, sediment deposition, landscaping, or modern development.

XPI may include manual and/or mechanical excavations, as appropriate, including, but not limited to, trenching, shovel test pits (STPs) and auger borings. XPI investigations should be conducted to confirm the presence or absence of archaeological deposits in areas where archaeological resources are reported or suspected, but surface evidence is either lacking or not visible due to dense vegetation cover or sediment deposition. STPs and auger borings will cease when either positive or negative results are obtained. All XPI investigations will be limited to the APE.

These efforts will be documented in a sASR and will follow the requirements for the documentation and recording of newly-discovered resources outlined above. Additionally, each trench location, STP, and/or boring/auger location will be given a unique identifier and be plotted

using GPS. A map of these XPI excavation locations using GIS will be prepared and included in the sASR. The sASR will indicate where excavation resulted in the identification of cultural materials. The sASR will also identify which sites will require formal test excavations and evaluations and which resources can be avoided.

9.5 Geoarchaeological Investigations (Prehistoric Resources only)

Geoarchaeological investigations for the HST project are intended to assist the Authority and FRA in making a reasonable and good faith effort to identify archaeological resources within the APE prior to construction disturbances, as well as to inform the archaeological monitoring effort during construction. In this regard, geoarchaeological studies are an extension of the cultural resources inventory effort to specifically address the potential for buried archaeological deposits in the APE that would otherwise not be evident during surface inspections. The geoarchaeological investigations conducted to date for the Fresno to Bakersfield Section of the HSR project involved both literature research and targeted field testing at select locations along the alignment that were identified as highly sensitive, based on the literature research. The results of both the literature research and field studies are documented in the Fresno to Bakersfield ASR (Authority and FRA 2011b, 2013a), the Fresno to Bakersfield Extended Phase I Report (Authority and FRA 2011b [Appendix F]), and the Fresno to Bakersfield Geoarchaeological Investigation Report (Authority and FRA 2014d [Attachment B to this ATP]).

The geoarchaeological literature research conducted for the HST project focused on the landscape evolutionary history of the southern San Joaquin Valley, and in particular, the depositional history of the region since the time prehistoric human populations are believed to have first entered California (approximately 13,500 years ago). In order to better understand this geomorphic history, published geologic, geomorphic, and soils studies were analyzed for relevant information. In addition, previous archaeological and geoarchaeological studies in the vicinity were used to better understand the potential for buried archaeological sites in the southern San Joaquin Valley. Among the previous studies with particular relevance to the HSR project is the recent geoarchaeological overview and assessment conducted for District 6 of the California Department of Transportation (Caltrans) (Meyer et al. 2009). The Caltrans study provided a comprehensive analysis of the Quaternary depositional, erosional, and hydrologic history of the southern San Joaquin Valley, which encompasses the entire Fresno to Bakersfield Section of the HSR project. Based on the analysis, and correlation of mapped surface soil types with known radiocarbon dates and archaeological contexts, Meyer et al. (2010) developed a weighted geoarchaeological sensitivity model for the region, which addresses the potential for buried archaeological sites on a landscape scale directly relevant to the scale of the HSR project. The sensitivity model developed by Meyer et al. (2009) was therefore used as a baseline for determining the potential for the HSR project to affect buried archaeological resources. Based on this landscape-scale study, large portions of the HST APE were identified as having moderate to very high sensitivity, as depicted in Figure 4.2.

Following the literature research described above, and using the weighted sensitivity model developed by Meyer et al. (2010), a field investigation for the HSR APE was developed and implemented in order to test the sensitivity model and the assumptions about the Quaternary geomorphology of the region. In total, 21 geoarchaeological investigation trenches and six radiocarbon dates were completed for the HSR investigation, primarily in areas classified as Very High Sensitivity for buried archaeological resources, based on the weighted sensitivity model. No archaeological resources were encountered in any of the trenches; however, the presence of buried soils (paleosols) in the majority of the trenches, were of appropriate age to possibly contain archaeological deposits and, therefore, supported the model developed by Meyer et al.

In a few cases, exposed soil profiles and associated dates disproved the presumed sensitivity of a given locale.

The Geoarchaeological Investigation Report for the Fresno to Bakersfield HSR project (Authority and FRA 2014d [Attachment B to this ATP]) indicated that, due to the large areas of Holocene sedimentation and highly dynamic alluvial environment demonstrated by this investigation, it is difficult to anticipate precisely where buried archaeological resources will be located, as there appears to be strong variability in the preservation potential within highly sensitive areas, due to the presence of numerous abandoned channels (both major and minor) associated with the various drainages. This same variability is represented in the numerous paleosols observed and dated for this project. In addition, the Geoarchaeological Report acknowledges that the HSR project area has been almost exclusively dominated by agricultural activities during the historic period, and this agricultural activity has had a very dramatic impact on the natural environment and soils. Extensive grading of the southern San Joaquin Valley over the past 150 years has resulted in the disturbance, removal, and redisposition of native soils. With regard to the potential for buried prehistoric archaeological sites, this historic land use suggests the possibility of the complete removal and destruction of archaeological sites, as well as the potential for artificial burial of sites under imported fill.

Given the negative findings within the 21 geoarchaeological trenches excavated in areas identified as having "high" or "very high" sensitivity within the APE, as well as the infeasibility of conducting subsurface geoarchaeological investigations in all high sensitivity portions of the APE to completely rule out the possibility of disturbing potential buried properties during construction, no further geoarchaeological field trenching is proposed as part of this ATP. The areas of sensitivity identified as a part of the geoarchaeological investigation are shown in the Prehistoric Archaeological Sensitivity Map (Figure 4.2). Areas of prehistoric archaeological sensitivity will require monitoring by an archaeologist and tribal monitors as described in Section 10.2.1. While the sensitivity mapping will be further refined in the future to produce the Archaeological Monitoring Plans, it is anticipated that soil-disturbing activities will be monitored in all areas designated as "high" or "very high" in Figure 4.2.

9.6 Archaeological Evaluations

Upon completion of the pedestrian surveys in all or portions of the project APE, archaeological evaluations will be conducted to assess the research potential and eligibility for listing in the NRHP and the CRHR for all sites identified in the APE that cannot be avoided. Exceptions include:

- those properties which are obviously not significant as agreed to by the PI and AR,
- archaeological properties exempt from evaluation, as provided for in Appendix D of the PA and found not to meet CRHR significance criteria; and

Prior to conducting archaeological testing, a site-specific archaeological testing plan will be prepared outlining the research context and proposed methods that will be used in evaluating site significance. The research design will include a thorough discussion of the relevant research domains that the subject site could address and the required data sets that must be present to address those topics. The research design will also outline proposed methods for evaluation, including any archival research that is needed, as well as the methodological approach to conducting the archaeological fieldwork and will demonstrate that the approach is in conformance with the measures outlined below in this section. It is anticipated that historic period resources will require more extensive archival research (see Section 9.6.1 below) than the prehistoric sites in order to establish site association(s) prior to excavation. Section 13.2.11 outlines the requirements for an archaeological testing plan.

9.6.1 Archival Research (Historic-Period Resources only)

Prior to testing, site-specific research will be conducted, as applicable, to develop contexts for the evaluation and interpretation of historic period sites. Such research will focus on examining the documentary record to ascertain whether dates of occupation or associations with particular persons or businesses can be made for a given site. This information will be key in determining CRHR and NRHP eligibility.

Archival research conducted as a part of the site evaluation process for historic-period resources will include review of sources such as historic photographs, historic aerial photographs, historic maps, local directories, historic newspapers, local histories, and government documents such as census, assessor records, and probate records.

9.6.2 Combined Archaeological Testing and Data Recovery Program

In accordance with PA Stipulation VI.C.1 and MOA Stipulation V.A, this ATP provides for the use of a combined archaeological testing and data recovery program (see Figure 9.1). Approval from the AR is required prior to implementing this approach, which will be implemented primarily during construction in situations with resources that immediately appear to be NRHP-eligible. After approval from the AR, implementation of a combined archaeological testing and data recovery program will consist of the following steps:

- within 14 days of completion of the testing fieldwork, the PI will prepare an Archaeological Evaluation Report (AER) and Data Recovery Plan (DRP). This document will describe the testing efforts and results, and include recommendations regarding site eligibility based on the site integrity and the ability to address relevant research questions outlined in the research design. A data recovery plan, the requirements of which are outlined in Section 13.2.9, will also be included.
- following approval from the Authority and FRA, the AER and DRP will be submitted to SHPO for a 14-day review period.
- Upon SHPO concurrence, treatment will move into the data recovery phase for those resources identified as eligible properties.
- Project construction activities may proceed following completion of fieldwork
- After completion of the fieldwork and laboratory analysis, results of the treatment will be documented in a Combined Archaeological Evaluation and Data Recovery Report (CAEDRR). The report will be submitted to SHPO and concurring parties in accordance with Section 13.2.12 of this ATP.

If testing is not combined with data recovery, the results of testing and evaluation work will be documented in an AER, described in Section 13.2.8. After the Authority and FRA review, the AER will be submitted to the SHPO and concurring parties in accordance with Section 13.3 of this ATP.

Where sites are recommended as not being significant and no treatment/data recovery is recommended, construction can commence in the area after SHPO concurrence is obtained. Where data recovery is implemented for significant sites, construction can commence when archaeological fieldwork is complete, and any follow-up mitigation measures agreed to by the MOA signatories (such as controlled grading, protection measures, etc.) are implemented.

9.6.3 Archaeological Fieldwork Methods

The archaeological fieldwork may include the following procedures:

- Site surface survey and detailed mapping;

- Subsurface sampling through manual excavation of shovel test pits (STPs) and auger borings;
- Controlled excavation units (CEUs);
- Block exposures; and
- Mechanical excavation, including areal scraping and trenching.

A combination of methods will be used to determine the location and boundaries of subsurface deposits and subsurface features and to assess the integrity of those sites. Description of each of these methods will be included in the testing and data recovery plans.

9.6.3.1 Site Survey and Mapping Methods

The spatial relationship among artifacts and cultural features is considered critical information in evaluating the sites. Accurate mapping is necessary to assess whether spatial associations are fortuitous or represent different activity sets within a single period of occupation. Prior to any subsurface work, qualified archaeologists will conduct a resurvey at 3-meter (10-foot) intervals within the site boundaries and its immediate surroundings. Surface artifacts and/or concentrations of artifacts or other cultural features will be marked using pin-flags. The site boundaries will be refined based on the surface findings and a temporary site datum established.

Mapping of surface cultural features will be conducted using a GPS unit with sub-meter accuracy. Site boundaries and excavations will also be mapped using this method.

9.6.3.2 Excavation Methods for Testing and Data Recovery

Prehistoric Sites

At sites requiring subsurface exploration, testing will be accomplished through several excavation techniques including STPs, auger borings, CEUs, and mechanical excavation of trenches, as appropriate. Excavation methods will be described in archaeological testing plans, the requirements of which are described here and in Section 13.2.11. STPs will be used to detect the presence or absence of subsurface artifacts, as well as their horizontal and vertical distribution. The testing plan will outline the placement of STPs and how they will be excavated to a depth sufficient to demonstrate the presence or absence of a subsurface component, and the physical distribution of artifactual remains. All excavated soils will be dry-screened through a minimum 1/4-inch mesh.

Where subsurface deposits are present in STPs or auger borings, CEUs will be excavated to better characterize the deposit. CEUs will provide for controlled investigation of subsurface materials and examination of site stratigraphy. CEUs will be hand-excavated in 10-cm levels through culturally sterile sediments. All soil will be dry-screened through 1/4-inch or 1/8-inch mesh, as appropriate and all cultural materials will be retained for analysis. CEUs will be excavated into 20 cm of sterile soil, until an impenetrable surface (e.g., hardpan) is encountered or there is a dramatic decrease in the frequency of archaeological remains (less than three items per 10-cm level). Justification for the conditions under which excavations are terminated will be provided in the excavation reports. Column samples will be collected from selected CEUs and processed through mesh.

In addition, backhoe trenches may be excavated to examine site stratigraphy, identify subsurface features, and address the potential for buried site components capped by culturally sterile sediments. Backhoe trenches will be excavated by using a 3-foot-wide smooth-edged bucket; the length and placement of trenches will be determined based on proposed project impacts and surface indications of site structure. Mechanical excavations will be conducted in shallow lifts (approximately 10-cm increments) until native soil or the limits of the equipment are reached. Mechanically excavated sediment may be partially screened and actively monitored by an

archaeologist, with artifacts exposed during excavation mapped and collected. It may also be necessary to employ mechanical scrapers to expose large areas where features are predicted to be near the surface or deposits are suspected to be thin.

All features identified will be individually investigated. The features will be bisected and hand-excavated to expose the feature in profile. Hand-excavated block exposures may be used to provide broader areal exposure of features.

All excavations will be measured in meters and centimeters. Archaeological field forms will be used to describe and record information associated with each excavated unit. All excavated areas will be backfilled. Archaeological team members will use GPS units to map STP and CEU locations. An overall site map will be prepared that clearly delineates the relative locations and sizes of each locus. All STPs, CEUs, and trenches will be backfilled.

All recovered cultural materials will be recorded by provenience. A tag containing excavation information (e.g., project number, bag number, test number, depth, and date) will be placed in each artifact bag. This information will also be written on the outside of the artifact bag. Artifacts will be taken offsite for laboratory processing and analysis, in accordance with the curation guidelines outlined in Section 12.2.

Additionally, documentation of prehistoric period cultural deposits will consist of a variety of documentation methods and media, which are briefly discussed below.

1. Site Cartography: A site map for the site will be made and updated daily showing the extent of any areal exposures, unit location, feature locations, and any other relevant provenience data.
2. Level Records: All units will be excavated in 10 centimeter levels. A Level Record will be completed that includes basic information on soil characteristics, cultural materials, and other relevant data obtained in excavation of the level of the unit.
3. Feature Records: Once identified and exposed, each feature will be recorded using a Feature Record. This form records basic information such as the feature’s number and type; its provenience and cultural associations; a general description including associated artifacts; a description of the soil matrix within and surrounding the features; special samples, photographs or video taken; and general remarks. A scaled drawing of each feature will be made on a separate sheet of graph paper, in the case of complex or large features, a soil profile drawing will also be included.
4. Field Photography: All field excavation and monitoring activities will be documented through the use of digital and 35 mm photography. All excavation photos will include a scale and north arrow.
5. Field Video Documentation: Field digital video documentation will be utilized as appropriate to supplement field forms and photographs. This additional documentation will allow the research team to present a video chronicling the archaeological process on the subject property, if desired, as well as aid in the analysis and full documentation of the archaeological deposits once fieldwork is complete.

Historic-Period Sites

Although there are no known historic-period archaeological sites in the APE, the following general field methodology will be used during test excavation and evaluation of historic archaeological sites if encountered. Methods for data recovery in the field are also presented in this section. A summary of general lab methods and special studies appears below.

For features identified during testing as potentially significant, the area under investigation will be expanded aereally until the horizontal boundaries of the feature can be determined, taking into

account construction, safety, and security concerns. The minimum level of effort that is reasonable and necessary will be undertaken in order to evaluate the resources. Hollow refuse features will be halved and excavated by stratigraphic layer. Refuse pits or sheet scatters will be sampled and associated soils will be screened as appropriate. Architectural and infrastructure features should be cleared to establish integrity and to determine the extent of any associated material or temporal markers.

With the exception of fragments of wood, concrete, or brick (which shall be noted but not collected) and some diagnostic ceramic and glass fragments, all of the cultural materials encountered will be systematically recovered and saved in appropriately labeled bags for later laboratory analysis and interpretation. Artifacts from features meeting significance criteria will be retained for laboratory analysis. If the AR determines that a feature is not significant or an historical resource for the purposes of CEQA, the AR will consider the possibility of saving artifacts for either teaching collections or interpretive purposes. If saving artifacts for these purposes is not practicable or appropriate, the AR will ensure that all collected materials will be redeposited on site. All excavation will be mapped and recorded, material types noted, and the reasons for abandoning the feature should be clearly articulated.

It is anticipated that some features, such as wells or privies, will extend deep into the ground. Entry into confined spaces will be consistent with the standards and regulations of the Occupational Safety and Health Administration. When such features are encountered, the surrounding soil will be removed by heavy equipment to achieve an acceptable slope. Features will only be excavated to the depth that they will be impacted by planned construction. A Safety Plan, as described in Section 22.4, will outline procedures to be followed for excavating in confined spaces in accordance with the Authority's Field Safety Handbook (Authority 2014).

If small and intact features, such as wells and privies, extend below the proposed depth of construction activities, they will be excavated to their bases to determine the range of dates in which they were deposited. Determining the absolute range of dates of a deposit or a feature is crucial to establishing association of the feature with particular residences, industries, or historic events relevant to addressing research questions outlined in the archaeological testing plan described in Section 13.2.11.

If a large feature is encountered that extends below the level of impact of planned construction, a sampling strategy will be developed and implemented in order to obtain an adequate sample for subsequent analysis. Such a strategy might include the excavation of test units, augers, or shovel probes to determine the depth and stratification of the feature. Hand excavation of archaeological features will allow the archaeological research team to better control the exposure of artifacts in order to ascertain their dates of deposit. In addition, hand excavation of features will provide better provenience of artifacts and structural remnants to allow for analysis of spatial patterns relevant to addressing research questions described in archaeological testing plan described above in Section 11.4. The PI, in consultation with the AR, will determine the proper level of effort. As a general rule, the minimum amount of excavation should be performed to allow a significance determination to be made.

When appropriate, excavated soils will be passed through 1/4-inch or 1/8-inch (6 mm or 3 mm) mesh screens to document all classes of artifacts. Obtaining a representative sample of all classes of artifacts in encountered features will be important to address relevant research themes. Soils samples, seed samples or other deposits will be taken, as necessary, for further analysis, such as pollen and microbotanical analyses. Recovered materials will be bagged according to provenience. Materials will be documented on field notes as appropriate.

Recordation methods on historic period archaeological deposits will employ Feature Records and documentation of soil profiles for each feature. Each feature will be assigned a number and

described on a Feature Sheet. The Feature Sheet allows the recorder space to provide an overview of the feature and includes a description of the feature itself as well as overview of the materials it contained.

After excavation, the excavator will complete a soil profile drawing and Feature Evaluation Sheet for the feature that the PI will review. The Feature Evaluation Sheet summarizes knowledge about the feature, evaluates it, and registers the recommended determination of eligibility. Such documentation will ensure that the archaeological potential of the feature has been adequately addressed. The project team will provide periodic updates to the AR to summarize the information contained in the Feature Evaluation Sheets.

Documentation of historic period cultural deposits will consist of a variety of documentation methods and media, which are briefly discussed below.

1. Site Cartography: A site map for the site will be made and updated daily showing the extent of any areal exposures, unit location, feature locations, and any other relevant provenience data.
2. Level Records: All historic period features will be dug by stratigraphic layers. A Level Record will be completed that includes basic information on soil characteristics, cultural materials, and other relevant data obtained in excavation of the level.
3. Context Records: In addition to level records, context records will be used to record historic-era deposits association to each other. This is particularly useful in the recordation of subsurface refuse features such as privies and trash pits because it provides information on the relationship between soils differences and concentrations of artifacts; thus, information on differing deposit episodes across time, but within the same feature and/or level.
4. Features within contexts or contexts within features will be recorded. Feature records are discussed further below. The soil characteristics and cultural materials within each context will be recorded. Each context will be assigned a separate, arbitrary number for recording purposes.
5. Feature Records: Once identified and exposed, each feature will be recorded using a Feature Record. This form records basic information such as the feature’s number and type; its provenience and cultural associations; a general description including associated artifacts; a description of the soil matrix within and surrounding the features; special samples, photographs or video taken; and general remarks. A scaled drawing of each feature will be made on a separate sheet of graph paper, in the case of complex or large features, a soil profile drawing will also be included.
6. Field Photography: All field excavation and monitoring activities will be documented through the use of digital and 35 mm photography. All excavation photos will include a scale and north arrow.
7. Field Video Documentation: Field digital video documentation will be utilized as appropriate to supplement field forms and photographs. This additional documentation will allow the research team to present a video chronicling the archaeological process on the subject property if desired, as well as aid in the analysis and full documentation of the archaeological deposits once fieldwork is complete.

9.7 Supplemental Inventory and Evaluation Report and Findings of Effects

Following finalization of the design process and after completion of the additional identification (Phase I and XPI) and evaluation-level (Phase II) archaeological studies and reporting described in Section 13.2, a supplemental FOE (sFOE) document will be produced for all newly identified

historic properties in the APE. If no new historic properties are identified or no potential adverse effects are identified, a sFOE will not be required.

The sFOE will document the application of the Section 106 criteria for adverse effects as required by the PA and MOA for each new historic property identified within the APE. The sFOE may also document if the project will impact an historical resource under CEQA. This will include newly discovered historic properties (NRHP eligible or listed and CRHR eligible or listed) that were not already documented in the FOE, as well as a determination of effects on those resources already documented in or adjacent to the APE but for which the completion of the design phase reveals new, previously unidentified impacts. In the case of new adverse effects, the sFOE will also make specific recommendations regarding avoidance, minimization, and mitigation of effects to the affected historic properties. Section 13.2.4 of this ATP describes the SHPO and concurring party review for the sFOE.

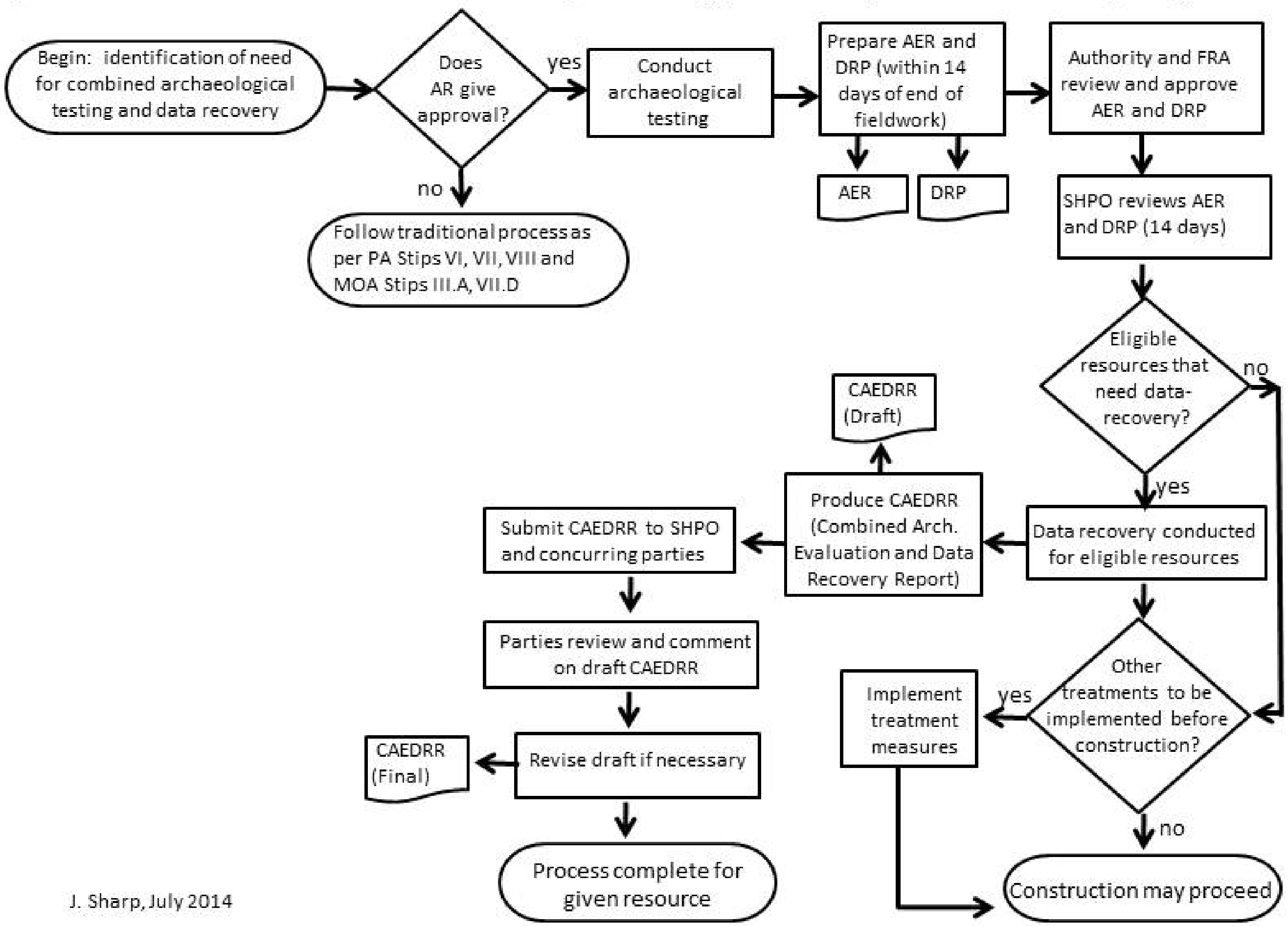

Figure 9.1 Flowchart of Combined Archaeological Testing (Evaluation) and Data Recovery Program

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10.0 Treatment Measures

During the course of consultation with the MOA signatories, the measures described here may need to be refined or modified to address newly identified resources or new effects. Additionally, opportunities for creative treatments including public benefit mitigation will be considered in consultation with the MOA signatories as appropriate.

10.1 Pre-Construction Treatment Measures

10.1.1 Treatment Measures for Known Archaeological Sites

CA-TUL-473

Additional inventory and evaluation is needed for this sparse scatter of lithic debitage and artifacts spread over a plowed field. The general vicinity of the site is located in a sensitive archaeological region given the proximity to Tulare Lake and the abundant resources the lake likely provided in prehistory. The site area is currently the location of bermed holding ponds that are flooded as part of Alpaugh Irrigation District activities, and as a result it was probably a large site that has been disturbed and re-deposited over a large area. Due to the amount of re-deposition or spreading the site has experienced, no intact or discrete deposit at this location was recorded. Due to lack of access, there was not enough information available to determine whether the portion of the site within the APE is eligible for the NRHP or the CRHR. Therefore, an archaeological testing program will be implemented to help identify whether substantial archaeological deposits exist within the APE at the recorded location of CA-TUL-473 when access to the parcel is obtained.

At that time, surveys and evaluative testing for CA-TUL-473 are required in order to assess the site's integrity and significance. This work will be conducted using the methods detailed in Section 9.6.3. In summary, work will begin with a thorough pedestrian survey of the site followed by a combined program of auguring, surface transect units (STUs), and trenching to be placed throughout the site boundaries to identify the presence and distribution of subsurface archaeological materials and guide further investigations as to the stratigraphic integrity of the deposits.

Should the testing determine that intact deposits are present at the recorded location of CA-TUL-473, work will include controlled excavation of areas with indications of intact subsurface deposits and the site will be evaluated for significance in accordance with the procedures outlined in Section 9.6, "Archaeological Evaluations." If the deposits are found significant under Section 106 and CEQA, Additional provisions found in Section 10.1.3 Data Recovery, will be followed if avoidance is determined to be infeasible.

CA-KER-2507

The project will be constructed in the vicinity of the recorded boundaries of CA-KER-2507, the reported location of the Yokuts village site Woilo. This area has been leveled and urbanized and prior subsurface testing concluded that no portions of the site exist (Chase 1994); however the geoarchaeological assessment conducted for the Fresno to Bakersfield Section ASR concluded that this location would be highly sensitive for buried deposit potential (Authority and FRA 2012a).

Because this area is currently developed, a testing plan cannot be developed until legal access to the parcel is obtained and the details of acquisition and demolition of existing facilities are known. Once access is obtained, work will be conducted to locate any archaeological deposits

that potentially still exist intact in the APE at this location. This effort will include an archaeological testing program that will include a combined program of auguring, mechanical excavation, and surface transect units (STU) placed throughout the portion of the APE where the site is thought to have been located. Because the site is the location of an ethnographic village, it is not expected that materials associated with its use are deeply buried. Additionally, they could be quite thin or ephemeral. Therefore, it may be necessary to expose larger areas using a mechanical scraper rather than excavating trenches, which are more useful in finding deeply buried sites.

Should the excavations determine that intact deposits are present at the recorded location of CA-KER-2507, the site will be evaluated for significance in accordance with Section 9.6, "Archaeological Evaluations." If the deposits are found significant under Section 106 and CEQA, additional provisions found in Section 10.1.3, "Data Recovery", will be followed if avoidance is determined to be infeasible.

10.1.2 Completion of Inventory and Evaluation

This process is addressed in detail in Section 9, "Plan for Completion of Historic Property Inventory Efforts for Archaeological Resources."

10.1.3 Data Recovery

It is possible that the two known sites (see Section 10.1.1 above), as well as sites that will be identified as part of the inventory phase or during construction monitoring, will require data recovery excavation. If intact subsurface cultural deposits are determined eligible for the NRHP and the CRHR and cannot be avoided, data recovery will be performed to mitigate and treat the loss of data under Criterion D of the NRHP and Criterion 4 of the CRHR.

Site-specific data recovery plans, as described in Section 13.2.9 will outline the approach to treatment in terms of data collection, analysis, and reporting standards and will be consistent with California SHPO guidelines (California State Office of Historic Preservation 1990). In general, the methods employed for data recovery will be similar to those described in Section 9.6, Archaeological Evaluations; however, a greater level of post-field analysis will be conducted as part of the data recovery effort to include radiocarbon dating, obsidian hydration and sourcing, residue analysis, pollen analysis, faunal analysis, and macrobotanical analysis.

10.1.4 Construction Drawing/Resource Mapping

After the design is sufficiently advanced, a geospatial data layer will be produced overlaying the locations of all known archaeological resources within the APE, for which avoidance measures are necessary, and all archaeologically sensitive areas, for which monitoring is required, on the construction drawings. This task will require synthesizing data provided from all records searches, inventory reports, and evaluation reports. It may be necessary to produce these maps in phases as design is finalized to meet construction priorities.

10.1.5 Completion of Archaeological Monitoring Plan(s)

It is anticipated that more than one Archaeological Monitoring Plan may be developed and implemented, in order to accommodate the phased nature of the design-build construction method being utilized. The goals and content of the Archaeological Monitoring Plans are described below in Section 10.2.1.

Individual Archaeological Monitoring Plans must be completed sufficiently prior to construction to allow for the individual plans to be reviewed and approved prior to construction in the subject area(s).

10.1.6 Avoidance/Protection Measures/BMPs

The ability to shift the rail alignment to avoid any new sites identified within the APE is limited by the design constraints associated with achieving the necessary speed requirements for the train. For other project features within the APE, such as access areas, construction laydown areas, and utilities relocations, avoidance may be a viable option, and is the preferred strategy for addressing effects to historic properties. For significant sites where such measures would be successful in avoiding adverse effects, avoidance and protection measures will be developed and implemented in consultation with signatory and concurring parties to the MOA. All avoidance and protection measures for archaeological resources will be delineated on the construction drawing/resource mapping layer.

10.1.7 Cultural Resources Worker Awareness Training

Because cultural materials can be difficult to identify, cultural resources awareness training is mandatory for all onsite construction personnel to limit the possibility of irreparable damage to important undocumented resources. Onsite construction personnel include all personnel who require site access as a regular and routine part of their job duties; such personnel include but are not limited to the site supervisor, skilled and unskilled laborers, and heavy equipment operators. Training will address artifact and archaeological feature identification as well as the mandatory procedures to follow should potential cultural resources be exposed during construction. For training to be effective it must satisfy the following conditions:

- It must be simple and accessible;
- It must be universal and mandatory; and
- It must be reviewable and revisable.

Prior to being permitted onsite access, all construction personnel will attend a short (approximately 1 hour) instructional presentation created by the PCM under the direction of the AR. After viewing the presentation, all onsite construction personnel will be required to sign an affidavit indicating that they have viewed the presentation and understand their legal and contractual responsibilities with respect to identifying and reporting potentially important cultural resources onsite.

Instructional materials will be presented in a straightforward jargon-free manner so that onsite construction personnel can quickly acquire the basic skills needed to identify potentially important cultural resources in real-world situations. Because the identification of potentially important cultural resources is primarily a visual exercise, the instructional presentation will be predominantly visual in focus and will include easily recognizable and detailed examples of potentially important cultural resources. To accommodate differing levels of education and literacy, instructional materials will be available in online-with-audio and print formats in English and Spanish language versions.

Paper copies of instructional materials in English and Spanish will be kept onsite and made accessible to all employees. Updated training materials may be supplied to contractors should additional content be deemed necessary during construction. Training materials will discuss the following topics:

- Why preserving and documenting cultural resources are important;
- Why construction monitoring is necessary;

- The difference between historic and prehistoric materials;
- The difference between artifacts, features, and structures;
- Identifying common prehistoric artifacts;
- Identifying common historic artifacts;
- Identifying archaeological features in the field;
- Inform workers of the legal implications of willful resource disturbance; and
- Mandatory procedures for reporting possible cultural resources, and a summary of the stop-work process described in Section 11.

10.2 Treatment Measures to be Implemented during Construction

10.2.1 Construction Monitoring

Archaeological and tribal monitoring of ground-disturbing construction activities with a potential to affect archaeological remains shall occur in areas that have been identified as archaeologically sensitive. Archaeological sensitivity is based on: areas in close proximity to known archaeological sites; areas identified by the tribal consulting parties as sensitive for Native American cultural resources; and/or geoarchaeological analyses, which address the potential for archaeological remains (including buried archaeological remains) based on soil type and landform (as depicted in Figure 4.2). Following the historic properties identification effort for Fresno to Bakersfield Section, the Contractor will finalize the Archaeological Sensitivity Map, as needed, based on the results of the historic property identification effort. The Final Archaeological Sensitivity Map will serve as a basis for communication with construction personnel regarding the need for monitors. Sensitive areas identified on the map will be delineated on the construction drawings. While the current sensitivity mapping will be further refined in the future for inclusion in the Archaeological Monitoring Plan, and will likely include some small additional areas (such as known site locations and areas of historic-period archaeological sensitivity), it is anticipated that soil-disturbing activities will be monitored in all areas designated as "high" or "very high" in Figure 4.2.

Archaeological Monitoring Plan(s)

It is anticipated that more than one Archaeological Monitoring Plan may be developed and implemented, in order to accommodate the phased nature of the design-build construction method being utilized.

Prior to ground disturbing construction activities, an Archaeological Monitoring Plan will be prepared by the Contractor identifying areas for archaeological monitoring. This plan will be based on the final Archaeological Sensitivity Maps prepared after the inventories and geoarchaeological fieldwork are completed, and will include details regarding the protocols and procedures for archaeological monitoring, unanticipated discoveries, and the treatment of human remains in accordance with the requirements outlined in the PA, MOA, and this ATP.

The Archaeological Monitoring Plan(s) will describe the number of monitors required for each construction activity and include the parameters that will influence the level of effort for monitoring, such as proximity of work to sensitive areas, and the types of activities that will require full time monitoring as opposed to spot checks. See Section 13.2.7 for additional details regarding the preparation of the Archaeological Monitoring Plan(s).

Archaeological Monitoring

All archaeological monitors will operate under the direction of the PI, who is responsible for coordinating and notifying the monitors regarding construction schedules and locations. Under the direction of the PI, both archaeological and Native American monitors will be present during

earth-moving activities (e.g., grubbing, clearing, grading, and trenching) involving native soils in areas identified as sensitive for prehistoric archaeological remains, based on the final Archaeological Sensitivity Map. The Archaeological Sensitivity Map, prepared by the Authority, will provide a baseline from which to develop a monitoring scope of work.

Archaeological and Native American monitors will work as a team and be onsite to observe ground-disturbing construction activities in archaeologically sensitive areas during construction. During the course of monitoring, the team will not be divided.

The number of monitors will depend on the number of locations where earth-moving equipment is working, as well as the types of construction activities being conducted. The Monitoring Plan will outline the how construction activities will be monitored including how many monitors will be need during construction. It is anticipated that at least one team of Archaeological and Native American monitors will be assigned to earth-moving equipment, such as drill rigs, backhoes, or bulldozers. Larger earth-moving equipment (e.g., belly scrapers) may require one monitor to observe earth removal and another to inspect backdirt produced by the machine. If additional coverage is needed, additional archaeological and Native American monitors will be deployed. For some project-related impacts, such as vibrated or driven piles, no subsurface exposures or backdirt will be created and, thus, monitoring is of little utility and will not be required.

If cultural resources are exposed during construction, the archaeological monitor will temporarily halt construction near the find to assess the need for further investigation in accordance with the procedures outlined in Section 11 of this ATP.

Native American Monitoring

As discussed above, the AR will coordinate with the tribal concurring parties who have participated in the development of this ATP to identify the appropriate Native American Monitors in advance of project construction. The Authority will seek to identify Native American monitors who meet the minimum qualifications in the guidelines provided by the California NAHC (2012); however, tribes will be responsible for identifying and vetting the qualifications of the individual monitors whom they wish to represent their tribe. The AR will coordinate with tribal leadership to identify the individuals who will represent their tribes as monitors.

The Contractor will be responsible for retaining the services of Native American monitors and will ensure that all interested tribes have an equal opportunity to participate in the monitoring. The AR will work closely with the tribes to engage the Native American monitors in the monitoring program and ensure that all tribes are given an equal opportunity to participate in the monitoring effort. The PI will provide notice of the cultural resource monitoring work schedule to participating tribes and tribal monitors at least 48 hours prior to commencing work whenever possible. In the case where multiple tribes have an interest in monitoring the same area, a schedule for systematically rotating monitors will be established among all participating tribes through continuing consultation with the Authority. During construction monitoring, Native American monitors will report to and work under the direct supervision of the PI. Tribal monitors will report any concerns to the onsite archaeological monitor during the monitoring effort. If tribal monitors have additional concerns that cannot be addressed onsite, the tribal monitors should contact either the PI or the AR.

The Contractor's PI will be responsible for coordinating with the tribal monitors and will serve as the point of contact for the tribal monitoring effort. A notice of the schedule and location of impending cultural resource monitoring work will be provided by the PI to participating Native American monitors at least 48 hours prior to commencing work. Depending on the amount of monitoring work needed and the number of participating monitors, monitors from the various tribes may need to be systematically rotated to ensure each tribe has an opportunity for

representation during the monitoring effort. If tribal monitors from a given tribe are unavailable upon notification from the Contractor regarding scheduled monitoring work, a tribal monitor from will be solicited from another tribe until an alternative monitor has been identified to cover the work. If no Native American monitors are available, or if a scheduled monitor fails to appear onsite at the scheduled time, the AR may authorize the Contractor's work to proceed.

The Native American monitors are expected to report to their tribal government or designee to keep them informed of project activities. The Native American monitors will be working under the direct supervision of the PI. Native American monitors do not have the authority to halt equipment or issue a stop-work order. Native American Monitors report any suspected discoveries during construction to the onsite archaeological monitor. The Native American monitors should report any issues or concerns regarding the monitoring effort to the PI and/or the AR.

10.2.2 Observation of Protocols for Unanticipated Discoveries

See detailed description in Section 11.0, below.

10.2.3 Ongoing Cultural Resources Worker Awareness Training

The Cultural Resources Worker Awareness Training described above in Section 10.1.6 will be an ongoing program that continues throughout the duration of construction activities, in order to ensure that new workers are trained.

10.2.4 Maintenance and Supplementation of Construction Drawing /Resources Mapping

The mapping described above in Section 10.1.4 will be maintained and updated as design plans change or become more fine-grained, and as new resources are discovered, whether during inventory efforts or project construction activities.

10.2.5 Maintenance and Supplementation of Avoidance and Protection Measures

All cultural resources-related avoidance and protection measures will be delineated on construction drawings. If maintenance is required to ensure that the measures are effective in protecting cultural resources, the PI working with the PCM will establish a mutually agreed to maintenance and monitoring schedule to check the status of the protection measures. Ineffective avoidance and protection measures will be corrected under the direction of the AR.

10.3 Post-Construction Treatment Measures and Ongoing Maintenance Measures

Post-construction treatment measures are much more common for built environment cultural resources (e.g., restoration of original landscaping, etc.) than for archaeological resources. At the present time, no post-construction treatment measures have been identified for archaeological resources, but this does not preclude the possibility of future identification of post-construction treatment measures, especially in relation to Native American concerns having to do with the discovery of human remains, or the discovery of archaeological resources with unique traditional or spiritual qualities.

Table 10.1 Draft Treatment Implementation Schedule

Treatment (with relevant sections of ATP shown in parens)	**Pre-Construction**	**During Construction**	**Post-Construction ***
Inventory (Sections 9.1 – 9.5, 9.7, 10.1.2, 13.2.5)	Sufficiently prior to construction to ensure evaluation and data recovery fieldwork is completed prior to construction activities at given location.	Inventory efforts continue during construction; see "Pre-Construction" column to left.	N/A
Evaluation (Sections 9.6, 9.7, 11.1.4, 13.2.8, 13.2.12, 13.2.13)	Sufficiently prior to construction to ensure evaluation and data recovery fieldwork is completed prior to construction activities at given location.	Evaluation efforts continue during construction; see "Pre-Construction" column to left.	N/A
Data Recovery (Sections 9.6.2, 9.6.3, 10.1.3, 13.2.9, 13.2.10, 13.2.12, 13.2.13)	Sufficiently prior to construction to ensure data recovery fieldwork is completed prior to construction activities at given location.	Data recovery continues during construction; see "Pre-Construction" column to left.	N/A
Complete inventory and eval. for known sites: **CA-TUL-473** **CA-KER-2507** (Section 10.1.1)	Sufficiently prior to construction to ensure evaluation fieldwork and (if necessary) data recovery fieldwork is completed prior to construction activities in site vicinity.	Regardless of findings, would be monitoring during construction in accordance with monitoring plan.	N/A
Construction Drawing Resources Mapping (Sections 10.1.4, 10.2.4)	Sufficiently prior to construction to ensure resources are adequately mapped.	Maintain and update during construction.	N/A
Archaeological Monitoring Plan(s) (Sections 10.1.5, 10.2.1, 13.2.7)	Sufficiently prior to construction to ensure that the plan is prepared, reviewed, and approved prior to construction.	Implement and adjust as needed during construction.	N/A
Avoidance/Protection Measures/BMPs (Sections 10.1.6, 10.2.5)	Sufficiently prior to construction to ensure resources are avoided and/or protected.	Maintain and update during construction.	N/A
Cultural Resources Awareness Training (Sections 10.1.7, 10.2.3)	Prior to construction.	Ongoing through construction.	N/A
Archaeological Monitoring (Sections 10.2.1, 11.0 - 11.2.3, 13.2.7)	N/A	In accordance with monitoring plan.	N/A

Native American Monitoring (Sections 10.2.1, 11.0 – 11.2.3, 13.2.7)	N/A	In accordance with monitoring plan.	N/A
Observation of Protocols for Unanticipated Discoveries (Sections 10.2.2, 11.0 – 11.2.3)	N/A	In accordance with this ATP.	N/A

**No post-construction treatment measures have been identified at this time; see Section 10.3.*

11.0 Procedures for Unanticipated Discoveries during Construction

Previously unknown archaeological resources, including human remains and Traditional Cultural Properties (TCPs), could be discovered during ground-disturbing construction activities. The procedures provided here for unanticipated discoveries during the construction process comply with PA Stipulations VIII.B and XI, and MOA Stipulation VII, and are consistent with the following federal and state standards and guidelines:

- National Park Service, The Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716–42 [1983]), as amended.
- *National Park Service Bulletin, Guidelines for Evaluating and Documenting Traditional Cultural Properties* (National Park Service 1998).
- Guidelines for Implementation of the California Environmental Quality Act, as amended (Title 14 California Code of Regulations Chapter 3, Article 9, Sections 15120–15132).
- All activities performed under the unanticipated discoveries plan will be consistent with the stipulations presented in the PA; federal regulations defined in 43 CFR 10; California Health and Safety Code, Section 8010 et seq.); and the California Public Resources Code Section 5097.98. This process is provided in accordance with 36 CFR 800.13(a) (2).

11.1 Protocols for Archaeological Discoveries (not including Human Remains)

The sections immediately below describe the protocols to be implemented in the event of an archaeological discovery that does not appear to consist of or include human remains. These protocols are presented in chronological order, beginning with the relatively informal process of a temporary work stoppage, and progressing through a formal stop-work order, consultation with MOA signatory parties and concurring parties, and, finally, the evaluation and treatment of discoveries. These procedures are diagrammed in detail in Figures 11.1 and 11.2.

11.1.1 The discovery of human remains, either as an initial discovery or as a subsequent discovery within a larger archaeological deposit or site, requires implementation of the additional protocols detailed below in Section 11.2. Protocols for Temporary Work Stoppages

If an archaeological monitor, Native American monitor, the PI, or construction personnel observe or suspect any potential archaeological resources during ground-disturbing construction activities, the onsite archaeological monitor will issue a "temporary work stoppage" to the equipment operator to allow for a closer inspection of the discovery. When the archaeological monitor issues the temporary work stoppage, all ground-disturbing construction activities within a 50-foot radius of the point of discovery will halt immediately to allow the onsite archaeological monitor to inspect and assess the materials, and determine whether additional analysis of the find and a stop-work order are warranted, or whether construction can precede without further investigation. Ground-disturbing construction activities may continue outside the area of the discovery, but the area of the discovery will remain undisturbed by construction activities until the archaeological monitor can complete an inspection.

If an archaeological monitor is not present and suspected resources are observed, the Contractor shall immediately stop ground-disturbing activities within a 50-foot radius of the find, and contact the archaeological monitor, archaeology PI, CRCM, and the environmental lead for the PCM. While the archaeological monitor will probably be the first environmental specialist to arrive at the point of discovery, any of these four other entities can issue a temporary work stoppage in

the absence of, or until the arrival of, an archaeological monitor and Native American monitor. Tribal interests are represented by the pairing of Native American monitors with the archaeological monitors, as prescribed above in Section 10.2.1. For prehistoric discoveries, a Native American monitor should therefore be summoned separately to the point of discovery in cases where the archaeological monitor will not become directly involved in the investigation of the discovery (e.g., in cases where discovery is handled directly by the Archaeology PI).

The temporary work stoppage is an informal procedure that may become routine in areas of high archaeological sensitivity. As such, it is intended to be implemented quickly by field personnel, as needed, and also terminated quickly by those same field personnel, as appropriate. Temporary work stoppages do not trigger consultation with MOA signatory parties.

Examples of common scenarios that might trigger temporary work stoppages include:

- Discovery of an isolated artifact (e.g., prehistoric materials such as flaked stone, or isolated historic-period artifacts) in a location where no larger archaeological deposit is encountered or observed;
- Discovery of faunal remains (e.g., shell or bone) or fossils that are initially thought to be of potential cultural origin, but upon closer inspection are determined to be naturally-occurring; or
- Discovery of modern debris initially thought to be of possible historic-period age.

Temporary work-stoppages can be terminated by the archaeological monitor or by the Archaeology PI, by informing the Contractor, CRCM, or construction personnel that ground-disturbing activities can resume.

11.1.2 Protocols for Stop-Work Orders

If, during the course of a temporary work stoppage, the archaeological monitor determines that further investigation may be necessary, the archaeological monitor will notify and consult with the PI regarding the discovery. In accordance with PA Stipulation XI.B, if the PI determines that adverse effects on the resource can be avoided, no consultation with MOA signatories and concurring parties is necessary. If the PI determines that the archaeological discovery may be NRHP or CRHR eligible and adverse effects cannot be avoided, the PI will issue a stop-work order and will notify the AR of the discovery. At the direction of the PI, the PCM implements the stop work order by directing the Contractor to stop all ground-disturbing activities within a specified area determined by the Archaeology PI, and for a minimum estimated length of time estimated by the Archaeology PI. The physical boundaries of the area cannot be less than a 50-foot radius from the point of discovery, but the Archaeology PI may identify a larger area, depending on the nature of the find. The actual duration of the stop-work order will depend entirely on the nature and extent of the find, and on the consultation that takes place to identify appropriate treatment measures.

The stop-work order is a significantly more formal and time-consuming process than the temporary work stoppage, as it results in consultation with MOA signatories. As such, this process should be used judiciously, and reserved for situations in which there is the potential to identify NRHP or CRHR-eligible properties.

A stop-work order is terminated when, at the direction of and in consultation with the AR and PI, the PCM notifies the Contractor that work may be resumed in an area for which a stop-work order was previously issued.

11.1.3 Initial Consultation with MOA Signatory Parties (in event of Stop-Work Order)

In accordance with PA Stipulation XI.B, the Authority will consult with the FRA within 24 hours of a discovery for which a stop-work order has been issued to determine whether the unanticipated discovery is an eligible or potentially eligible property that will be adversely affected by the project. Within 48 hours of the discovery, the Authority will notify the SHPO of the discovery by phone or email. If the Authority and FRA determine that the property is likely an eligible or potentially eligible property that would be adversely affected by the project, they will develop recommendations regarding the proposed treatment measures to minimize adverse effects on the discovered resource. The Authority, in consultation with the FRA, will provide the SHPO with the recommended approach to treating the discovery. Consultation with the SHPO on the discovery will be conducted via email and phone, with hardcopy documentation on the treatment to follow. If the Authority and FRA determine, in consultation with the SHPO, that the unanticipated discovery is not eligible and no further investigation is warranted, the PI will notify the PCM that clearance has been granted to resume work in the area.

11.1.4 Initial Consultation with Tribes and other Concurring Parties (in event of Stop-Work Order)

In accordance with PA Stipulation XI.C and MOA Stipulation VII.C, the Authority shall notify the FRA, and then the Authority shall notify all Native American consulting and concurring parties of any prehistoric discoveries for which a stop-work order has been issued within 24 hours of the discovery. After reviewing such discoveries, federally-recognized Native American Tribes can request further consultation on the project by notifying the FRA in writing within 48 hours of the Authority providing notice of the discovery. After reviewing such discoveries, Native American groups that are not federally recognized can request further consultation on the project by notifying the Authority in writing within 48 hours of the Authority providing notice of the discovery.

While Native American consulting and concurring parties will automatically be notified in the event of prehistoric discoveries, other MOA concurring parties will be notified, as appropriate, of both prehistoric or historic-period discoveries, depending on the nature of the find and the location of the find relative to the parties' area(s) of interest (e.g., the City of Bakersfield would not be informed regarding an archaeological discovery in the City of Fresno).

11.1.5 Evaluation and Treatment of Unanticipated Discoveries

Upon consultation between the Authority, FRA, SHPO, Native American consulting and concurring parties (in the case of prehistoric discoveries), and other MOA concurring parties with a potential interest in the resource regarding the appropriate treatment for an unanticipated discovery, the PI will prepare a draft Unanticipated Discovery Memorandum (UDM). The draft UDM will outline the nature of the discovery, its potential NRHP or CRHR eligibility, and proposed measures to treat the discovered resource, in accordance with this ATP (Sections 9 and 10), the MOA (Stipulations III, IV, and V), and the PA (Stipulations VI, VII, and VIII). The Authority will provide this memorandum to the FRA, SHPO, and all concurring and/or consulting parties with a potential interest in the resource within 48 hours of the conclusion of initial consultation between the Authority, FRA, SHPO, Native American consulting and concurring parties (in the case of prehistoric discoveries) and other MOA concurring parties with a potential interest in the resource. The FRA, SHPO, and all concurring/consulting parties will provide review and comment on the draft UDM within 24 hours. If no comments are received, the Authority will direct that treatment proceed in accordance with the draft UDM, which will become the "final" UDM. Minor comments will be addressed as appropriate in the "final" UDM, but any substantive disputes

regarding the evaluation of resources, or proposed treatments, will be resolved in accordance with MOA Stipulation VIII.C. As soon as the data recovery fieldwork and/or other agreed-upon treatment measures are completed (as determined by the PI and AR), work in the area of the discovery can resume. These efforts will be documented in accordance with the requirements set forth for an Archaeological Data Recovery Report (ADRR) as outlined in Section 13.2.10.

As stated above, a stop-work order is terminated when, at the direction of and in consultation with the AR and PI, the PCM notifies the Contractor that work may be resumed in an area for which a stop-work order was previously issued.

11.2 Additional Protocols for Discovery of Human Remains

All parties will comply with federal and state regulations and guidelines regarding the treatment of human remains, if discovered. This section details the procedures for consultation with the NAHC, tribal groups, and SHPO, as well as other steps that can be determined in advance of any such discovery.

There is no federal land within the current APE for the Fresno to Bakersfield Section. Therefore, unless the APE expands to include federal land, any human remains and funerary objects discovered during the implementation of the project will be treated in accordance with Section 106 and the requirements of §7050.5(b) of the California Health and Safety Code.

11.2.1 Stop-Work Procedures and Notification of Parties

If any construction personnel or an archaeological monitor or Native American monitor identify potential human skeletal remains or indicators of potential human skeletal remains, such as mortuary monuments (gravestones), or other funerary items, the archaeological monitor will issue a temporary work stoppage and notify the PI of the discovery. If the PI determines the remains to be neither human nor archaeological in nature (e.g., they are naturally-occurring animal bones, refuse from food or butchering, etc.), the Archaeological Monitor or PI will terminate the temporary work stoppage. If the PI determines the remains to non-human, but archaeological in nature (e.g., animal bones occurring as part of an archaeological feature or site), the discovery will be treated in accordance with Sections 11.1.1 and 11.1.2 above. If the PI determines the remains to be human, the PI will immediately notify the AR and the onsite RE of the discovery.

Concurrent with notifying the AR and onsite RE of the discovery of human remains, the PI will issue a stop-work order for the entire area within a 50-foot radius of the discovery. This area represents the minimum size of the stop-work area, but it can be defined as a larger area, as appropriate, at the discretion of the PI (in consultation with the AR). If the discovery is being left in place during a work stoppage, additional measures such as a security patrol or guard may be necessary. The PI and AR will determine the need and extent of the security measures to be taken; the Contractor will be responsible for hiring all security personnel. The discovery will not be touched, moved, or further disturbed. The Contractor will flag or fence off the archaeological discovery location and ensure security. The Contractor will not restart work in the archaeological discovery area until clearance has been granted by the Authority.

If the remains are determined to be human by the PI and AR, the PI will concurrently contact the county coroner, and inform FRA and any Native American consulting parties of the discovery. The county coroner will determine if the remains are modern, historic, or Native American. After examination by medical staff and law enforcement personnel, if the human remains are determined to be related to a criminal matter, the project activities in this location will cease and the matter will be addressed by the local law enforcement authorities. If the remains are determined to be historic and are not related to a criminal matter, the coroner will hold an

inquest in accordance with the California Public Resources Code, Section 27460. If the remains are determined to be Native American, they will be treated as outlined in Section 11.2.2 below.

11.2.2 Identification of Most Likely Descendant

Pursuant to §7050.5(c) of the California Health and Safety Code, if the county coroner determines that the human remains are or may be of Native American origin, the discovery shall be treated in accordance with the provisions of §5097.98(a)–(h) of the California Public Resources Code, which refers to the notification of discovery of Native American human remains, descendants, and the disposition of human remains and associated grave goods.

Once the county coroner determines that the remains are Native American, the coroner is then responsible for notifying the Native American Heritage Commission (NAHC), and the NAHC is responsible for identifying a "most likely descendant" (MLD) for the discovery. The MLD can inspect the discovery site of the remains, if necessary, and within 48 hours of their notification, the MLD will recommend to the Authority their preferred treatment of the remains and associated grave goods (if any).

11.2.3 Treatment of Human Remains

To the extent permitted by applicable law and regulation, the Authority must consider the views of the MLD when it makes decisions about the disposition of Native American human remains and funerary objects. The Authority will ensure the respectful treatment of each set of remains and funerary objects.

Treatment of the Native American remains may include the following:

- Non-destructive removal and analysis of remains and associated grave goods. Disinterment is to be conducted carefully, respectfully, completely, and in accordance with proper archaeological methods. If necessary, transport and storage of the remains will be done with due care.
- Preservation of remains and associated grave goods in place.
- Relinquishment of remains and associated grave goods to the MLD group for reburial.

After the treatment(s) for the Native American remains and associated items are mutually agreed on by the Authority and the MLD, the plan will be implemented.

In accordance with the California Public Resources Code Section 5097.98(e), if the NAHC cannot identify the Native American descendent group of the human remains, or if the MLD that has been identified fails to make a recommendation for the treatment of the remains, or if the Authority rejects the MLD's recommendation and mediation provided for in California Public Resources Code subdivision (k) of Section 5097.94 fails to provide measures acceptable to the Authority for the treatment of the remains, the Authority shall reinter the remains and associated grave goods with appropriate dignity on the construction property. The remains will be buried in a location on the property that will not involve any future construction activities.

Construction activities will resume in the discovery area once archaeological fieldwork has been completed and the PI issues a start work order (after consultation with AR).

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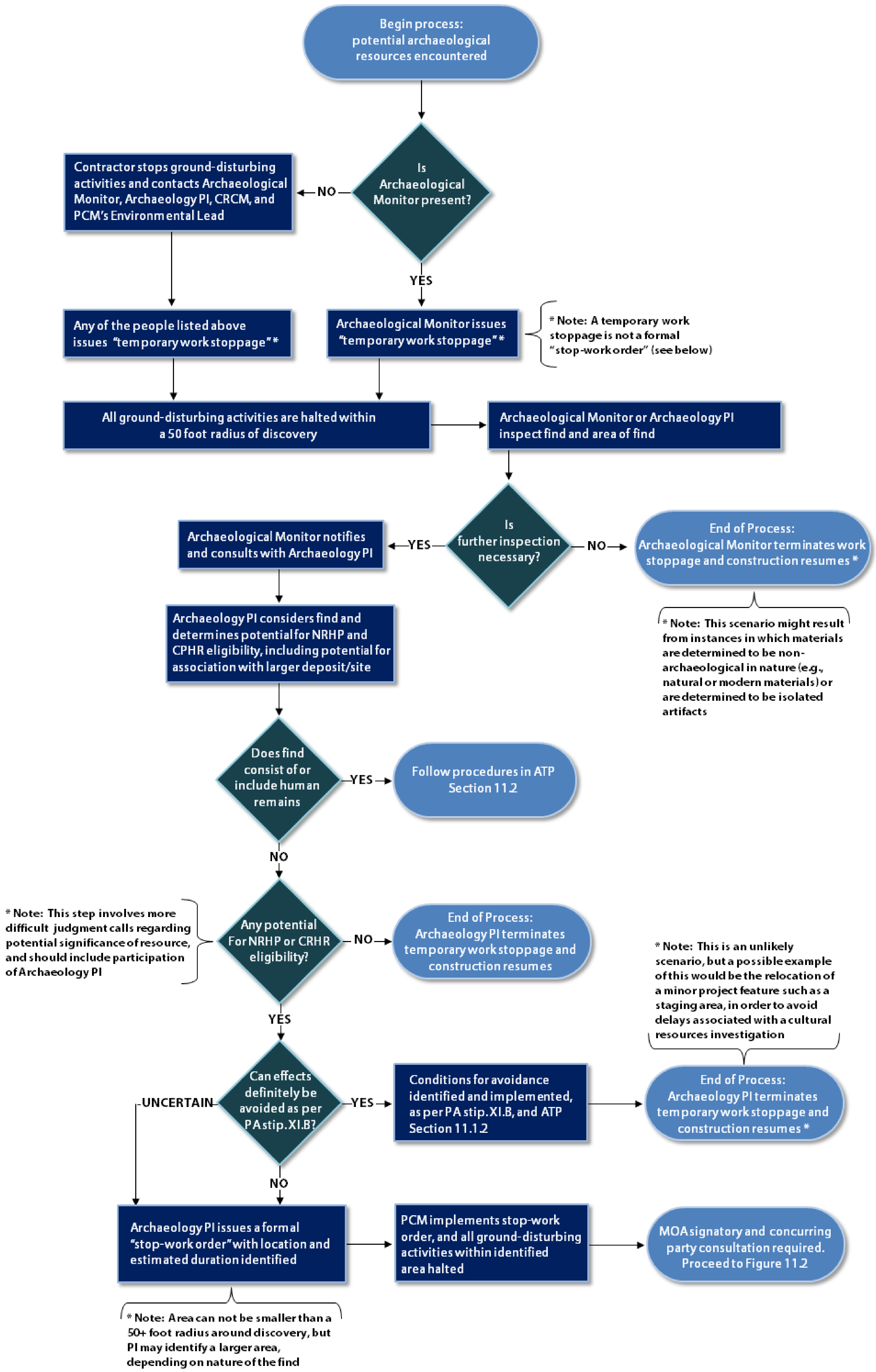

Figure 11.1 Implementation of Temporary Work Stoppages and Stop-Work Orders

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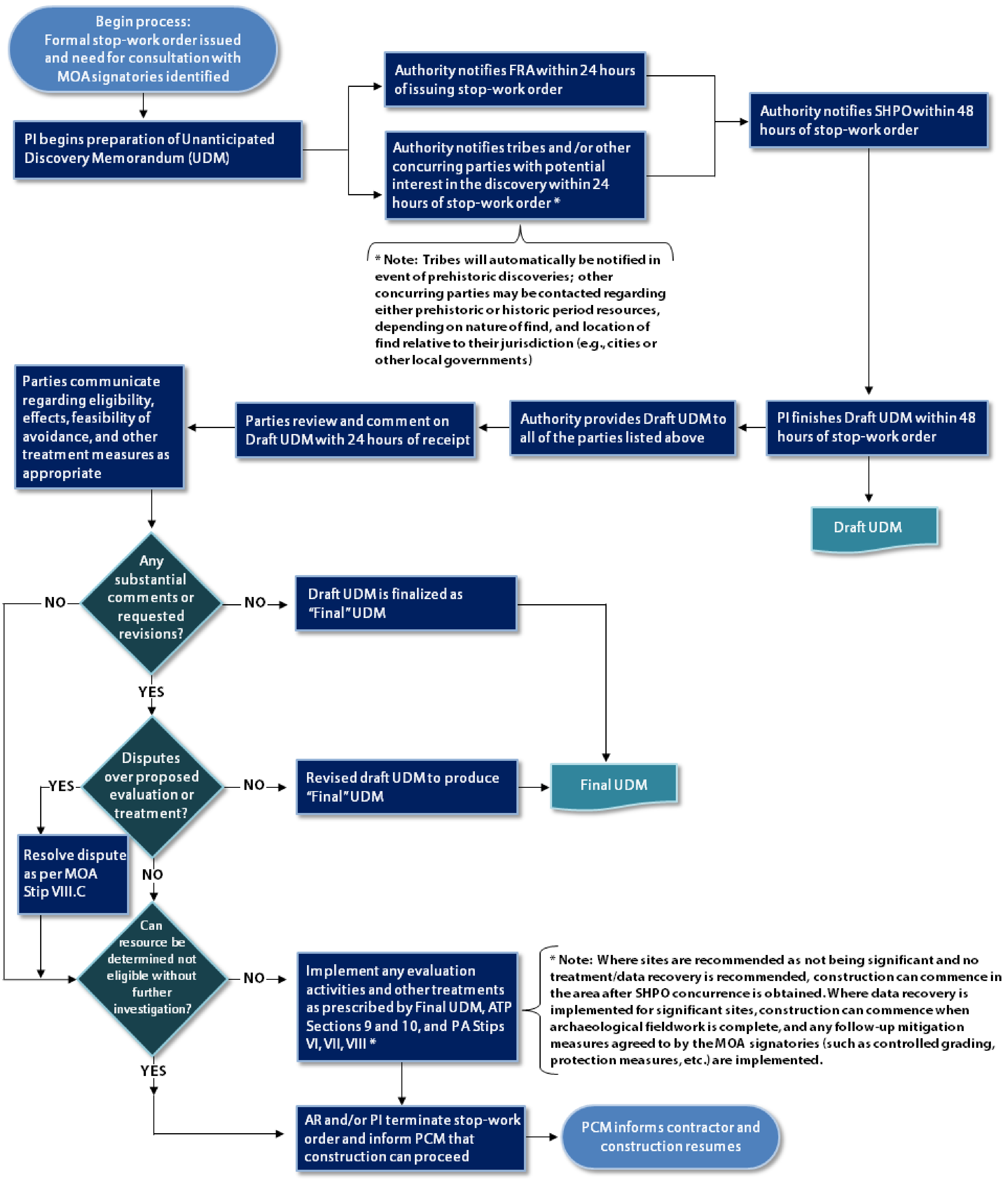

Figure 11.2 Consultation Process in Event of a Stop-Work Order

12.0 Public Involvement and Curation of Archaeological Materials

12.1 Public Involvement and Dissemination of Information

The Authority is currently developing a website to include information regarding the results of cultural resources studies conducted for the entire program. It is anticipated that as the results of the studies conducted in compliance with this ATP are finalized, information of interest to the public not subject to confidentiality requirements will be posted on this website.

12.2 Curation of Archaeological Materials

Curation guidelines for handling collections from federal, private, and state lands are outlined in PA Stipulation XIV and MOA Stipulation VIII.A. Materials recovered from archaeological investigations will be stored at a curation facility. This will require a formal agreement between the Authority and the facility and will be initiated prior to site evaluation work.

As outlined in the PA, all archaeological and historic materials, collections, and artifacts recovered during data recovery will be curated in the following manner:

Legal access must be obtained prior to implementation of any archaeological investigations. It is intended that properties will either be acquired by the Authority, or written permission from the property owner to conduct archaeological investigations or other ground-disturbing activities will be obtained prior to initiation of any field work. As archaeological materials are technically the legal property of the land owner from whose property the materials were derived, the Authority will identify property owners prior to conducting field investigations and provide for curation of artifacts and other cultural material collected in compliance with this ATP.

12.2.1 Federal Land

Under PA Stipulation XIV.A, federal agencies party to the PA will be responsible for curation of all records and other archaeological items resulting from identification and data recovery efforts on federal lands in accordance with 36 CFR 79. If the archaeological materials are determined to be of Native American origin, the agencies will follow NAGPRA regulations and procedures set forth in 43 CFR 10. However, due to the absence of federal land within the APE of the FB Section, it is not anticipated at this time that the requirements of NAGPRA or PA Stipulation XIV.A will come into play during implementation of this ATP.

12.2.2 Private Land

Under PA Stipulation XIV.B, private landowners will be encouraged to curate archaeological materials recovered from their lands in accordance with 36 CFR 79 and the provisions of 43 CFR 10. Materials collected from private land that are to be returned to the landowner after all necessary analyses have been completed will be maintained in accordance with 36 CFR 79, and 43 CFR 10 if the archaeological materials are determined to be of Native American origin. The Authority will document the return of materials to private landowners or alternate curation facilities and submit copies of this documentation to the affected parties to the PA.

12.2.3 State Land

PA Stipulation XIV.C requires that the Authority ensure that all cultural materials discovered on state lands will be curated in accordance with 36 CFR 79, the provisions of 43 CFR 10 if the archaeological materials are determined to be of Native American origin, and California Guidelines

for the Curation of Archeological Collections (State Historical Resources Commission 1993). The Authority will encourage state land agencies to consult with Native American tribes and groups affiliated with the cultural materials regarding repatriation. Appropriate treatment and disposition may occur through onsite reburial of the cultural materials recovered from state lands. If state agencies and consulting tribes cannot agree, the FRA will ensure that all cultural materials discovered on state lands are curated.

12.2.4 Other Provisions

Unless federal lands are encountered (thus necessitating compliance with NAGPRA), all artifacts, ecofacts, and any other recovered cultural material will be retained and will be considered to be the property of the Authority. The Authority will arrange for long-term curation of these materials. All materials that are to be curated will be placed in archival quality, long-term storage packing materials, including acid-free, lignin-free boxes and inert polyethylene bags. The Authority will also curate records prepared or assembled in connection with the project, including field notes, drawings, photographs, maps, special studies, and final reports. After completion of laboratory analyses and the production of the final report, the collection will be transported to the designated curation facility where it will be available for study by researchers.

Potential repositories include the Museum of Anthropology and Repository for Archaeological Collections at California State University, Bakersfield, the Archaeological Curation Unit at the University of California, Riverside, and an archaeological collections facility being developed by the Tejon Indian Tribe. A curation agreement will be obtained by the AR on behalf of the Authority prior to conducting investigations that could result in the collection of cultural material.

13.0 ATP Deliverables: Standards, Documents, and Schedules

13.1 Standards and Requirements for ATP Deliverables

All reports resulting from implementation of this ATP shall be consistent with the PA and the MOA for the Fresno to Bakersfield Section, and these reports must meet contemporary professional standards as specified in:

- *The Secretary of the Interiors Standards for the Treatment of Historic Properties* (National Park Service 1995 and updates);
- *The Secretary of the Interior's Standards and Guidelines for Archaeological Documentation* (National Park Service 1983 and updates);
- *California Office of Historic Preservation's Archaeological Resource Management Reports (ARMR): Recommended Contents and Format* (OHP 1990); and
- *California Office of Historic Preservation's Guidelines for Archaeological Research Designs* (OHP 1991).

13.2 ATP Deliverables

The parties responsible for producing each of the deliverables below are identified in Section 3 of this ATP.

13.2.1 Daily Logs and Weekly Reports

Daily logs will be prepared documenting all archaeological monitoring activities. These daily logs will be included in a weekly compliance report prepared by the CRCM, and be provided to the PCM and Authority.

13.2.2 Monthly Progress Reports

Monthly progress reports documenting the implementation of the ATP will be prepared and submitted via EMMA using a Summary Record Form associating all relevant standard Record Forms. Upon request, the monthly report will be provided to the MOA signatories. The progress report can be submitted in digital form and will, at a minimum, include the following:

- Name of project segment
- Date, person, and entity or firm preparing and submitting the report
- Activities conducted since the previous progress report, including the status of all fieldwork, analysis, or document preparation
- Activities planned for the upcoming month
- Known issues or potential issues affecting the implementation of the ATP or project schedule

13.2.3 Semi-Annual Status Reports

Semi-annual status reports will be prepared 30 days in advance of the schedule for semi-annual reports in the MOA. These reports will include a thorough discussion of the status of each activity outlined in this ATP and each stipulation of the MOA. The Authority will have thirty (30) days to review and comment on these reports. Reports will be revised by the CRCM based on comments received.

13.2.4 Draft and Final Safety Plans

The Contractor will prepare draft and final safety plans for the implementation of this ATP in accordance with the Authority's Field Safety Handbook (Authority 2014). Minimally the safety plan will cover the following topics:

- Assignment of a safety officer for the purposes of the work;
- Safety procedures for working around heavy equipment;
- Safety procedures working adjacent to highways and an active railroad;
- Trenching and shoring safety requirements;
- Preventing work-related *Coccidioidomycosis* (Valley Fever);
- Preventing heat-related illnesses;
- Handling possible hazardous waste in archaeological settings; and
- Safety procedures for excavating in confined spaces.

13.2.5 Supplemental Archaeological Survey Reports

A sASR to the Fresno to Bakersfield Section ASR will be prepared to document the results of the pedestrian archaeological survey of the previously inaccessible portions of the APE and any expanded areas of the APE resulting from the design process. Depending on construction priorities and property access/acquisition status, multiple sASRs may be prepared for portions of the APE for which surveys were completed in advance of other portions of the APE. Completed DPR continuation sheets and newly documented site forms will be filed with the appropriate California Historical Resources Information System (CHRIS) Information Center and included as an appendix to the sASR. Maps of the areas surveyed will be included in the sASRs. These maps will clearly delineate all archaeologically sensitive areas that will require archaeological monitoring during construction. This information will ultimately inform the final Archaeological Sensitivity Map prepared when inventories are completed. XPI investigations also will be documented in the sASR. The sASR will describe the reason the work was conducted and the results of the study. The report will address all cultural materials encountered and the extent and integrity of the deposits. If the XPI field effort results in a revision to the boundary or character of the site, an updated archaeological site form will be prepared and included as an appendix to the sASR. See Section 13.3 of this ATP for reporting and review requirements.

13.2.6 Final Archaeological Sensitivity Maps

Draft Archaeological Sensitivity Maps were prepared for this ATP (Figures 4.2, 5.1) based on the background research, field inventories, and geoarchaeological fieldwork conducted to date. After completion of the historic properties identification effort, these maps will be updated and revised by the Contractor, as appropriate. It is anticipated that more than one set of Final Archaeological Sensitivity Maps may be developed and implemented, in order to accommodate the phased nature of the design-build construction method being utilized. See Section 13.3 of this ATP for reporting and review requirements for the final Archaeological Sensitivity Maps.

13.2.7 Draft and Final Archaeological Monitoring Plan(s)

Draft and final Archaeological Monitoring Plans will be prepared identifying areas for which archaeological monitoring is required. It is anticipated that more than one Archaeological Monitoring Plan may be developed and implemented, in order to accommodate the phased nature of the design-build construction method being utilized.

The draft plan(s) will include the Final Archaeological Sensitivity Maps and will include details regarding the protocols and procedures for archaeological monitoring (including notification requirements), unanticipated discoveries, and the treatment of human remains in accordance

with the requirements outlined in the PA, MOA, and this ATP. The monitoring plan(s) will further outline the process for engaging Native American monitors in the monitoring program, describe the parameters influencing monitoring including the required number of monitors for various construction activities, proximity to work, types of activities requiring full time monitoring vs spot checks. See Section 13.3 of this ATP for reporting and review requirements for Archaeological Monitoring Plans.

13.2.8 Archaeological Evaluation Report

The results of testing and evaluation work will be documented in an AER. The AER will address field and laboratory methods and analysis and interpretation based on the research design/research issues, with guidance from the National Park Service Guidelines for Evaluating and Registering Archeological Properties (National Park Service 2000). The results of the investigation will provide the basis for NRHP and CRHR eligibility recommendations. Depending on the findings of these investigations, the Archaeological Sensitivity Mapping, which depicts the areas requiring construction monitoring, will be updated. See Section 13.3 of this ATP for reporting and review requirements.

If a new resource is determined to be NRHP-eligible, an sFOE Report will be prepared, as described in Section 13.2.14 of this ATP. If the resource is determined eligible and cannot be avoided, a site-specific Archaeological Data Recovery Plan will be developed and implemented for the resource as described in detail in Section 13.2.9 of this ATP.

13.2.9 Archaeological Data Recovery Plans

A site-specific Archaeological Data Recovery Plan (DRP) will be prepared for any adversely affected historic property identified that cannot be avoided. These plans can either be produced as a stand-alone document or included in a Combined Evaluation and Data Recovery Plan described below under Section 13.2.12.

Site-specific data recovery plans will conform to the principles in Parts I and II of *Treatment of Archaeological Properties: A Handbook* (Advisory Council on Historic Preservation 1980), the "Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation" (48 FR 44716–44742, September 29, 1983), and appropriate SHPO guidelines. The Authority and FRA will take into consideration the concerns of the concurring parties in determining the measures to be implemented.

Data recovery plans will include detailed consideration of the research potential of the affected resource(s) and the research issues/questions to which the data recovery investigation is expected to contribute. The DRP will also include a detailed description of the field, laboratory, and analytical methods proposed and a schedule for archaeological fieldwork and reporting.

13.2.10 Archaeological Data Recovery Reports

For each site that undergoes data recovery, an archaeological data recovery report will be prepared in accordance with the guidelines established by the Secretary of the Interior's Standards for Archaeological Documentation (Secretary of the Interior 1983) and the *Archaeological Resource Management Reports (ARMR): Recommended Contents and Format* (California Office of Historic Preservation 1990).

The comprehensive technical report will include the following elements:

- Executive summary
- Summary of project scope, including location and geologic and environmental setting

- Summary of previous research
- Applicable prehistoric, historic or ethnographic context
- Research themes identified in the research design
- Field methodologies employed
- Laboratory methodologies
- Results of special studies
- Interpretation of site findings, including relevance to research themes and recovered materials.
- Artifact catalogs
- Conclusions
- References cited

13.2.11 Archaeological Testing Plan

A site-specific archaeological testing plan is required to be prepared prior to conducting archaeological testing will be prepared outlining the research context and proposed methods that will be used in evaluating site significance. The plan will include a thorough discussion of the relevant research domains that the subject site could address and the required data sets that must be present to address those topics. The plan will outline the proposed methods for evaluation, including any archival research that is needed, as well as the methodological approach to conducting the archaeological fieldwork and will demonstrate that the approach is in conformance with the measures outlined below in this section. It is anticipated that historic period resources will require more extensive archival research than the prehistoric sites in order to establish site association(s) prior to excavation.

13.2.12 Combined Evaluation and Data Recovery Plan

When a combined archaeological testing and data recovery approach is proposed, within 14 days of completion of the testing fieldwork a Combined Evaluation Report and Data Recovery Plan will be prepared that describes the testing efforts and results. The report will include recommendations for site eligibility based on the site integrity and the ability to address relevant research questions as identified site specific evaluation plan.

After approval by the Authority and FRA, the Authority will submit the Combined Evaluation Report and Data Recovery Plan to SHPO and the concurring parties for a concurrent 15-day review and comment period. If no objection is made within the 15-day review period, the Combined Evaluation Report and Data Recovery Plan will become final. Any disputes would be addressed in accordance with the MOA. Upon SHPO concurrence, treatment will move into the data recovery phase for those resources identified as eligible properties.

The results of the data recovery will be documented in a Combined Testing and Data Recovery Report (see below) in accordance with the guidelines established by the Secretary of the Interior's Standards for Archaeological Documentation and the *Archaeological Resource Management Reports (ARMR): Recommended Contents and Format* (California Office of Historic Preservation 1990) and will describe in detail the data recovery fieldwork investigation and results.

13.2.13 Combined Evaluation and Data Recovery Report

Where testing and data recovery are combined, the results of the treatment will be documented in a Combined Testing and Data Recovery Report. This document will summarize the testing efforts and results described in the Combined Evaluation and Data Recovery Plan and will report on the results of the data recovery investigation. Upon review and approval by the Authority and FRA, the Authority will submit the Combined Testing and Data Recovery Report to the SHPO and

concurring parties for a 30-day review and comment period. If no objection is made within the 30-day review period, the Combined Testing and Data Recovery Report will become final.

13.2.14 Supplemental Effects Assessments

Upon completion of identification and evaluation-level archaeological investigations, a sFOE will be prepared for any historic properties identified within the APE. The sFOE will document the application of the criteria for adverse effects (36 CFR 800.5) for each historic property, which includes all newly discovered properties, as well as those resources already documented in the original FOE, but which had not been fully investigated at that time. The procedures for the assessment of effects to historic properties are detailed in Section 9.7, "Supplemental Inventory and Evaluation Report and Effects Assessments".

After review and approval by the Authority and FRA, the sFOE will be submitted to the SHPO and concurring parties for a 30-day review and comment period. Upon consideration and incorporation of SHPO and concurring party comments, as appropriate, a revised SFOE will be submitted to the SHPO for a 30-day review and concurrence period. If no objection is made within the 30-day review period, the sFOE would become final.

13.2.15 Final Supplemental Treatment Plan(s)

To address the Design-Build procurement process, it is anticipated that a final supplemental treatment plan will be prepared at a minimum for each of the construction packages; however, it may be necessary to prepare several final supplemental treatment plans in order to facilitate construction in certain areas or for specific activities, while the design for other areas or work is finalized later.

The FRA and Authority shall ensure that a final supplemental ATP or final supplemental ATPs are completed. These documents will describe treatments for as-yet-unidentified adverse effects to known or unknown resources and re-examine the treatments recommended in the original treatment plans and review final design to ensure that all properties adversely affected are addressed and that treatments are appropriate for the impacts that will result from the final design.

The final supplemental treatment plans will include as a minimum:

- Description of any additional APE that was added as a result of final design
- Any resources contained within including graphics illustrating the changes to the APE and new resources;
- Any new or different impacts that will occur as a result of final design or identification of construction methods;
- Description of the proposed treatment; and
- Research frameworks, as necessary, to provide a context for previously; and unidentified property types.

Final supplemental treatment plans will be provided to FRA by the Authority for a 14-day review period. Following FRA review and revision, the Authority shall provide draft final supplemental treatment plans to the MOA signatories for a 30-day review and comment period. Based on the comments received, the Authority will revise and submit the draft final supplemental treatment plans to the MOA signatories for final 30-day review. The Authority shall ensure that comments received as a result of this consultation process will be considered prior to finalizing final supplemental treatment plans.

13.2.16 Unanticipated Discovery Memorandum

If it is determined that an unanticipated discovery is potentially NRHP or CRHR eligible, an Unanticipated Discovery Memorandum will be prepared regarding the nature of the discovery, its potential NRHP or CRHR eligibility, and proposed measures to treat the discovered resource. This memorandum will be used to consult with the FRA, SHPO, and concurring parties following the process described in Section 11.0. The FRA, SHPO, and concurring parties will provide review and comment on the Unanticipated Discovery Memo within 24 hours. If no comments are received, the Authority will direct that treatment proceed in accordance with the Unanticipated Discovery Memorandum. If data recovery is conducted, this work will be documented in an ADRR in accordance with Section 13.2.10.

13.3 General ATP Deliverable Review Schedule

The MOA outlines review periods for all documents required to comply with the terms of the MOA. While the following discussion provides more detail on the cycles of review, nothing in this section supersedes the review requirements outlined in the MOA.

All draft documents prepared pursuant to this ATP will be submitted to the Authority's representative, the AR, for review. The AR will have a 30-day review period for all deliverables, exceptions noted below. If the AR determines revisions are needed, the AR will return the document to the author for a 30-day revision period. Upon acceptance of the document, the AR will forward the document to the FRA for a 30-review period. If the FRA determines revisions are needed, the FRA will notify the Authority and the AR will return the document to the author for a 30-day revision period. Upon acceptance of the document, the AR will forward the document to the other MOA signatories and concurring parties for a 30-day review period. The signatories and concurring parties will have 30-days to provide comments on the draft documents. After revision and the AR's determination that all comments are adequately addressed, the documents will be finalized.

Exceptions to this review schedule are provided for in the MOA and include deliverables with expedited review periods, such as the Unanticipated Discovery Memorandum review schedule described in Section 11.0.

14.0 Documenting and Monitoring the Status of Commitments

14.1 EMMA

Environmental Mitigation Management & Assessment (EMMA) is a database created by the Authority to document compliance with mitigation measures as prescribed by the EIR/EIS and MMEP, as well as conditions of the MOA and treatment plans. The database allows users to record implementation of compliance through the use of record forms designed specifically for each discipline.

The status of each environmental commitment outlined in this ATP will be tracked in EMMA through phases of pre-initiation, in-process, and upon successful completion of each commitment, that commitment's status is noted as completed in the system. The system allows for various records documenting compliance to be aggregated into summaries showing a comprehensive record of all actions documenting compliance with commitments and ultimately, the meaningful mitigation of impacts.

While the fulfillment of most commitments occur during the construction phase of the project, EMMA is also set up to track commitments during pre-construction, post construction and operations phases of the project.

14.2 EMMA Record Forms

Each discipline contains a form that doubles as a monitoring log, survey log, resource record or report submittal form. Users enter general details such as author name, author role and date of the record then selects the type of activity for which they are submitting a record such as Monitoring, Survey and/or Resource Tracking. Files, such as documents and photos, may be uploaded to the form for additional documentation.

Upon selecting Monitoring as the type of activity for which a user is reporting, a "monitoring form" loads on the screen. This form requests details such as start and end times, construction activities observed, equipment used, locational data, any compliance concerns noted, and additional fields to note observations about monitoring. Should a user have monitored multiple locations during a single day, the option to add an additional monitoring form to a single record is provided.

Upon selecting Survey as the type of activity, a "survey form" loads on the screen. This form requests details such as start and end times, type of survey, locational data and a field to note observations made during the survey. Should a user have multiple surveys to report, the option to add additional survey forms to a single record is provided. All final sASRs shall be attached to associated record or summary forms.

Upon selecting Resource Tracking as the type of activity, a "resource tracking form" loads on the screen. This form requests details such as whether the user is tracking a new discovery or tracking the ongoing status of a previous discovery, the resource's unique identification number, a description of the resource, it's context, locational data (including UTMs) and whether the resource requires additional management or evaluation as well as a field to note other observations about the resource. Should multiple resources require tracking, the option to add additional resource tracking forms is provided.

The two sites discussed within this ATP (TUL-473 and KER-2507) and any new sites or resources (including isolated artifacts and features) discovered through inventory or monitoring shall be

recorded using the "resource tracking form". Each unique site or resource shall be ascribed a unique identifier and a brief description of the resource. Photos, field notes and associated documentation shall be uploaded to corroborate details recorded on the form. All final reports shall be attached to associated record or summary forms.

Should a user need to report on an activity other than Monitoring, Survey and/or Resource Tracking, the Other activity option may be selected which provides generic fields to record the activity and a memo field to note information about the activity.

14.3 Treatment Compliance Schedule

This ATP identifies the treatments for known effects and a range of appropriate treatments for unanticipated effects on historic properties. Table 10.1 is a table showing which treatment measures will be implemented before, during, and after construction of the project depending on the timing requirements of the individual measures. This table is preliminary and will be updated in the final supplemental ATPs prepared by the Contractor. (To address the Design-Build procurement process, it is anticipated that a final supplemental treatment plan will be prepared at a minimum for each of the construction packages; however, it may be necessary to prepare several final supplemental treatment plans in order to facilitate construction in certain areas or for specific activities, while the design for other areas or work is finalized later). Table 10.1 will then be updated monthly as construction information is obtained and treatment measures are scheduled. Updated tables will be provided to the AR in the Monthly Progress Reports outlined in Section 13.2.2 of this ATP.

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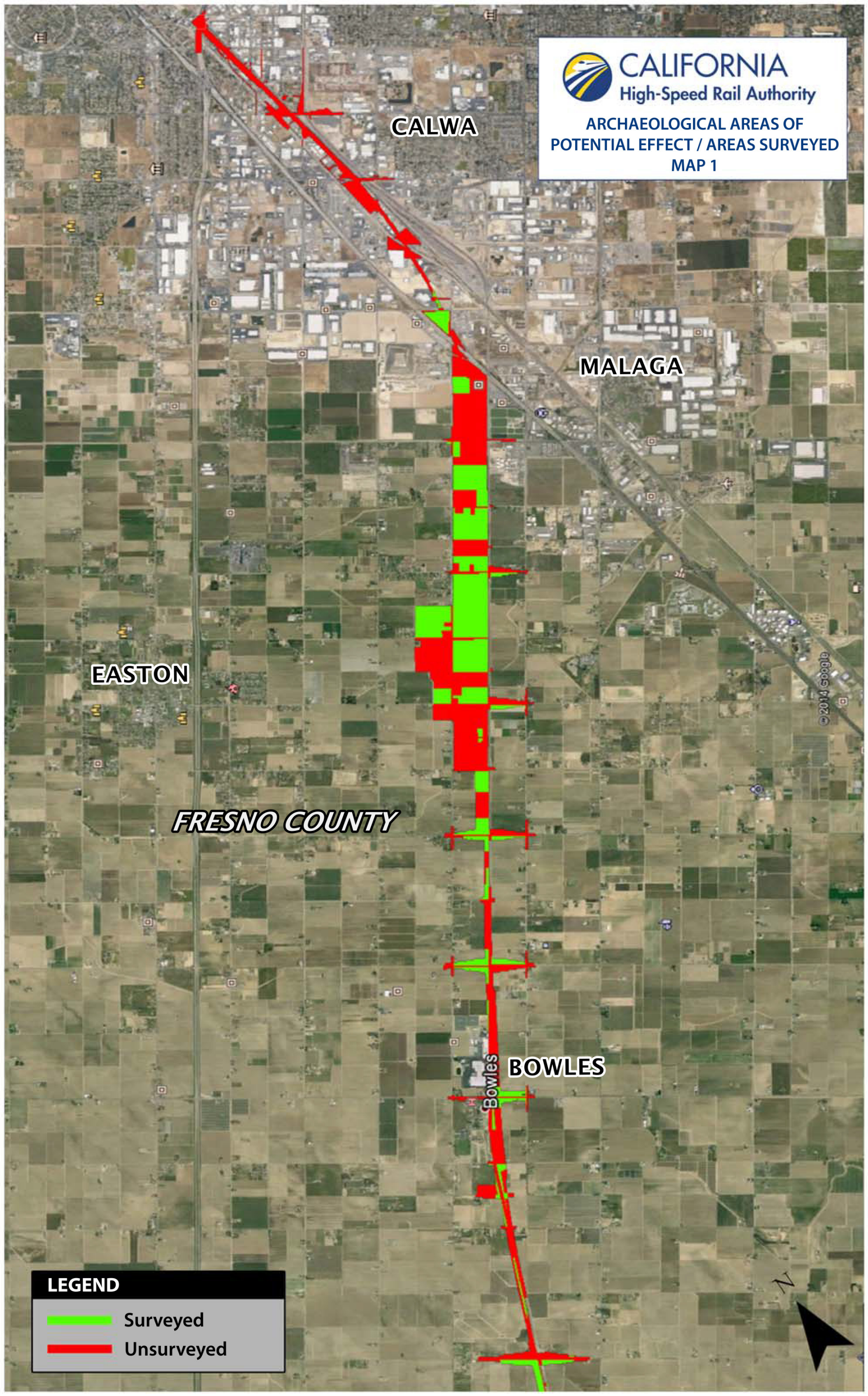
Attachment A:

Mapping of the Archaeological Area of Potential Effect (APE) and Survey Coverage for Construction Packages 1C and 2/3


CALIFORNIA
High-Speed Rail Authority
ARCHAEOLOGICAL AREAS OF
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MALAGA
EASTON
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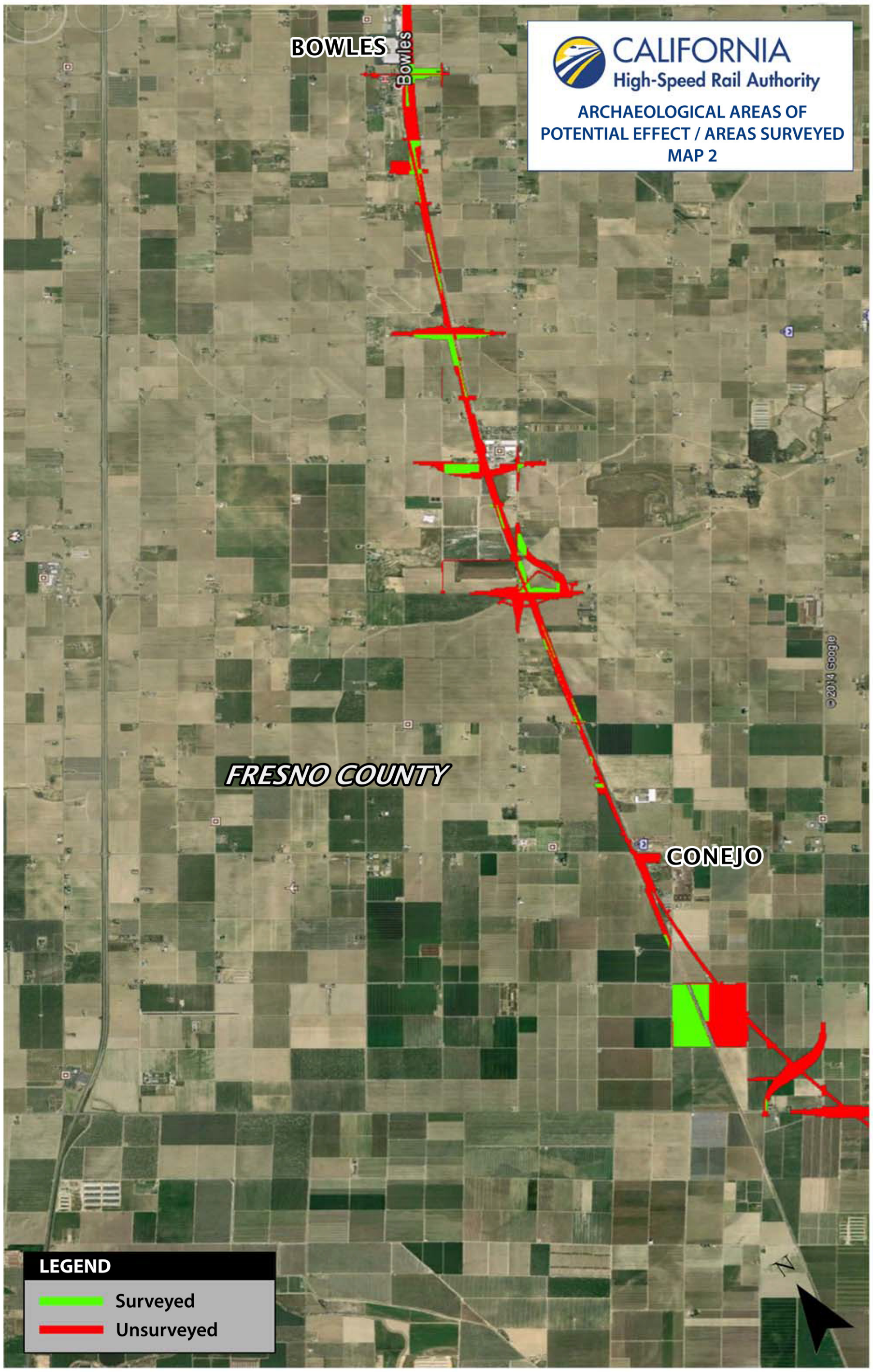
BOWLES
Bowles
LEGEND
Surveyed
Unsurveyed
N



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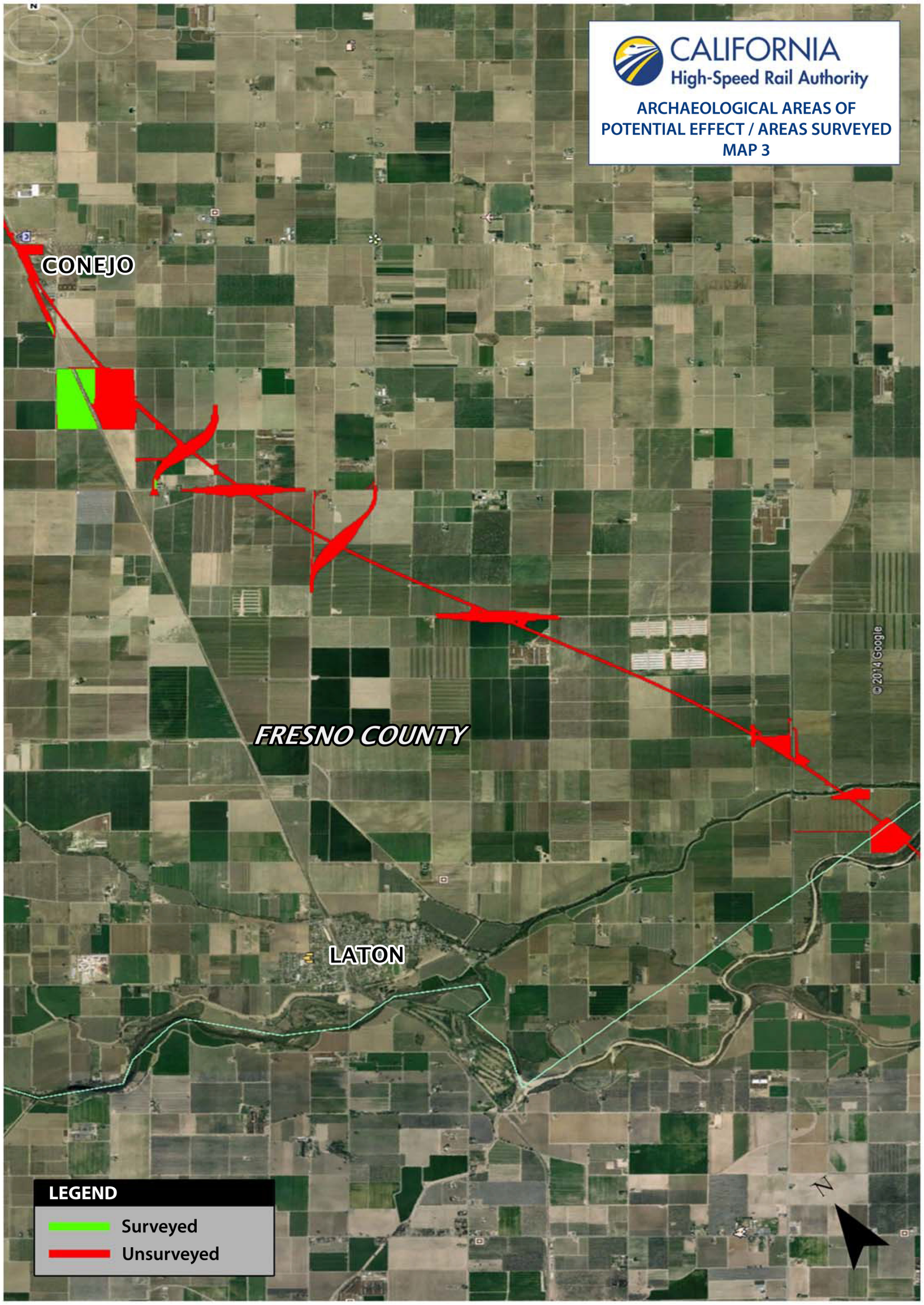
CALIFORNIA
High-Speed Rail Authority
ARCHAEOLOGICAL AREAS OF
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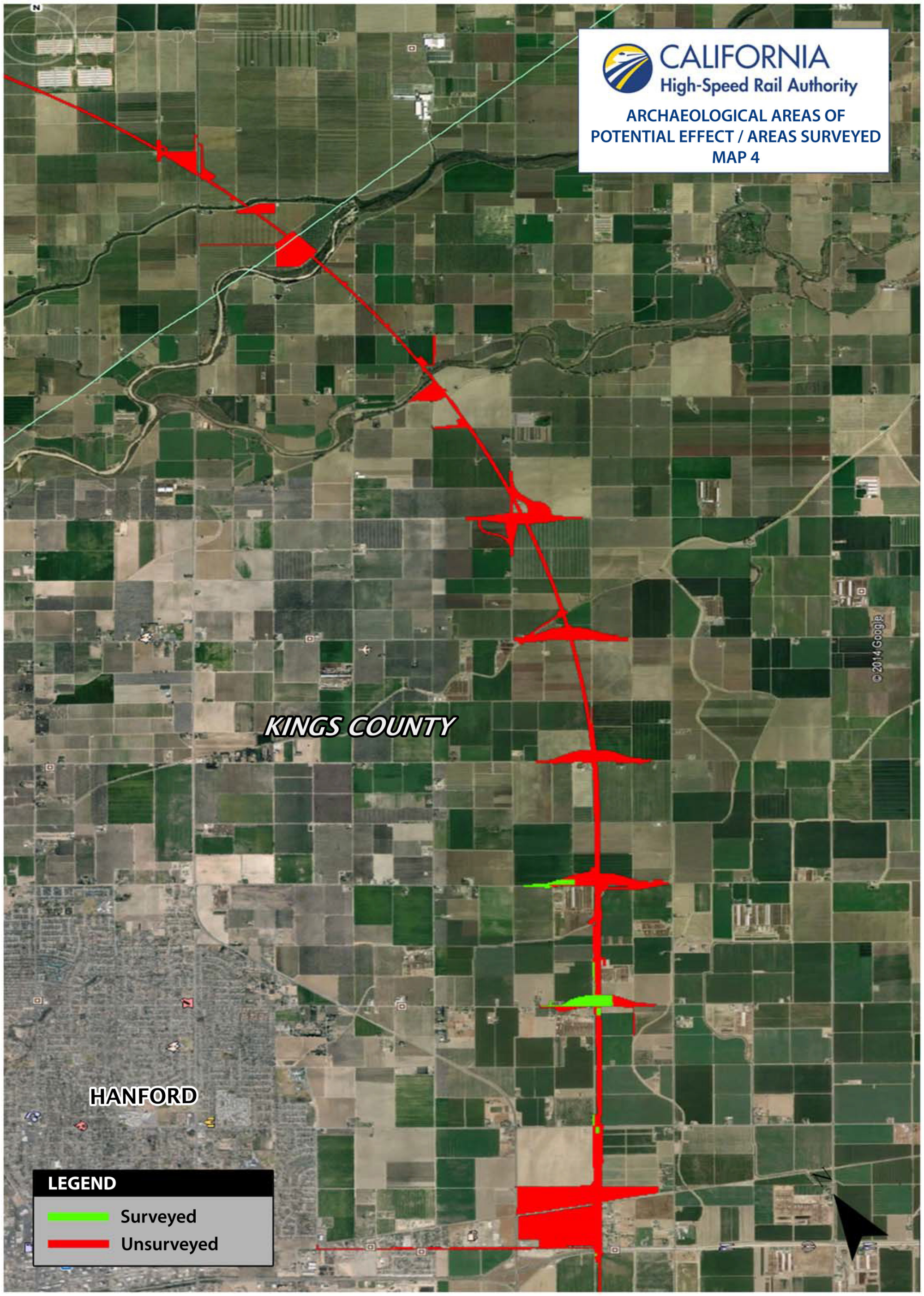
FRESNO COUNTY
LATON
© 2014 Google
LEGEND
Surveyed
Unsurveyed
N



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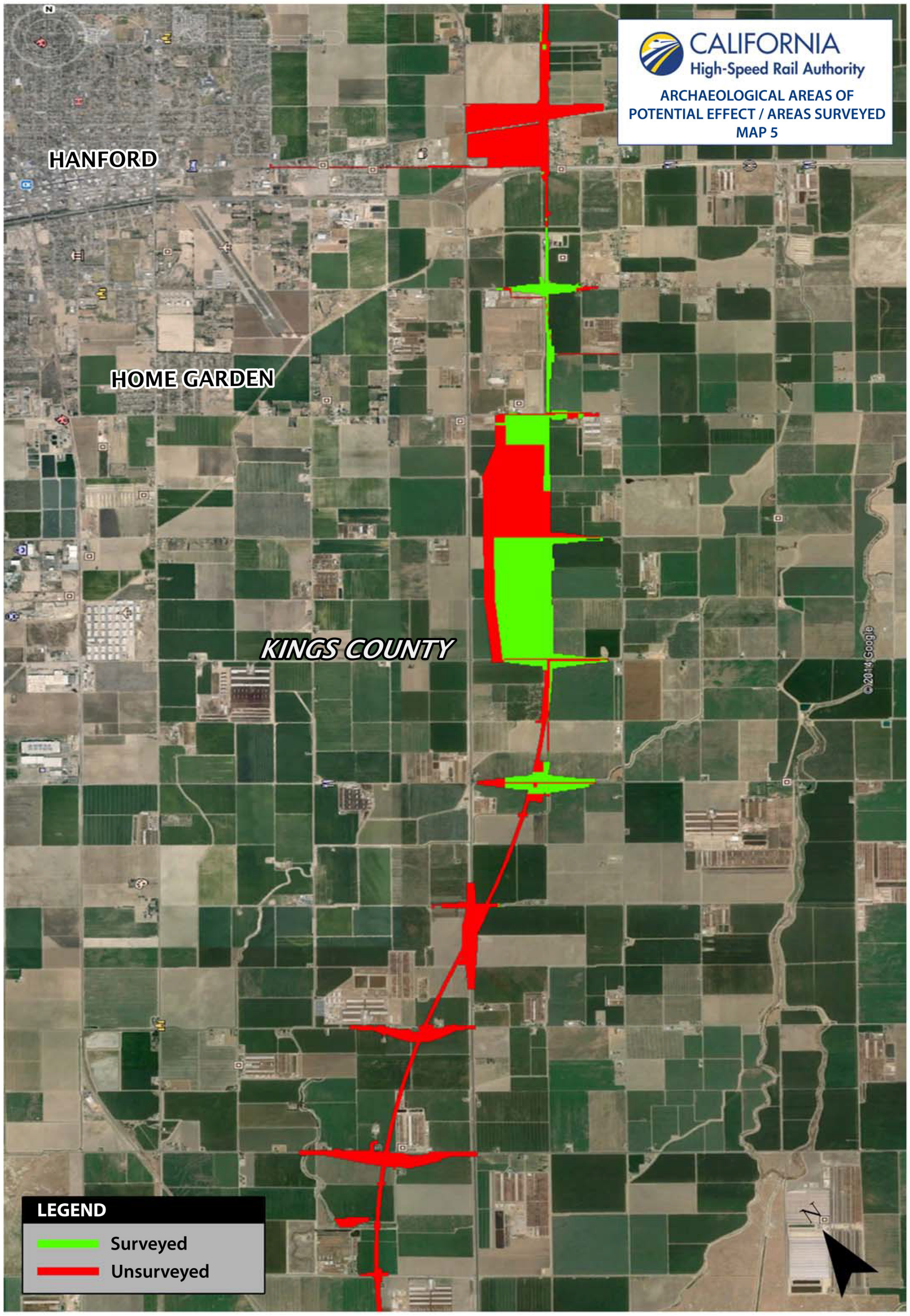

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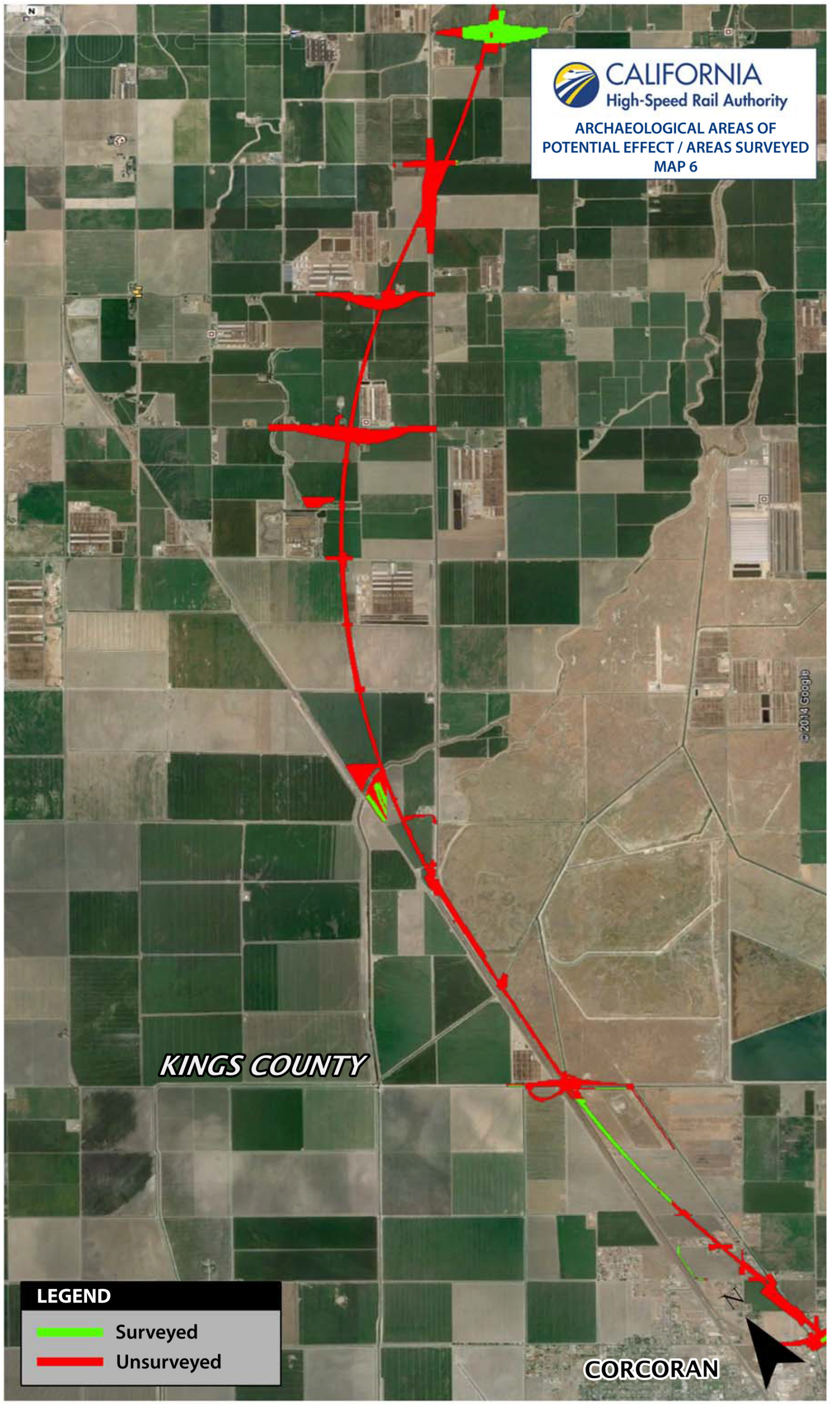
CALIFORNIA
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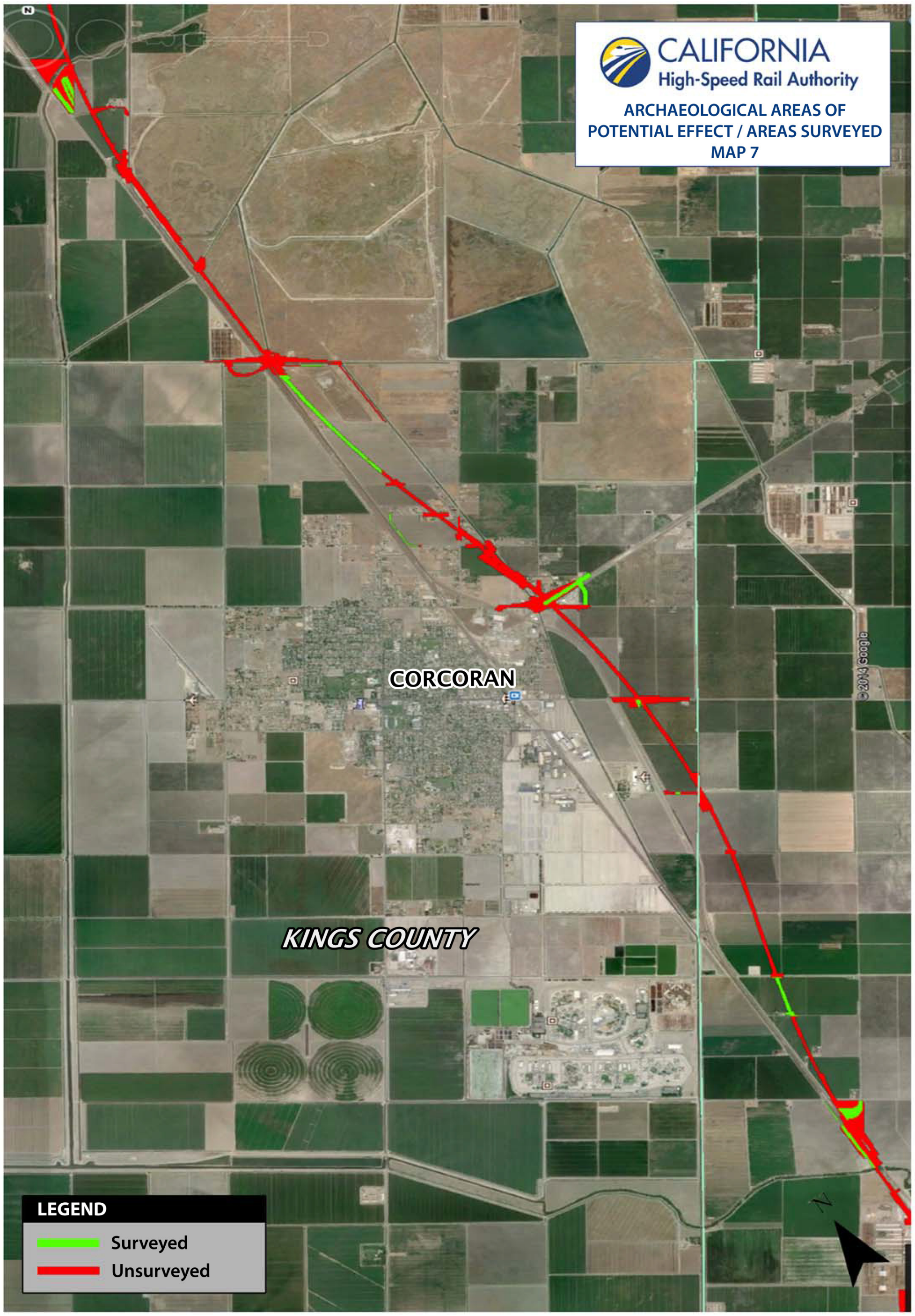
LEGEND
Surveyed
Unsurveyed
CORCORAN


CALIFORNIA
High-Speed Rail Authority
ARCHAEOLOGICAL AREAS OF
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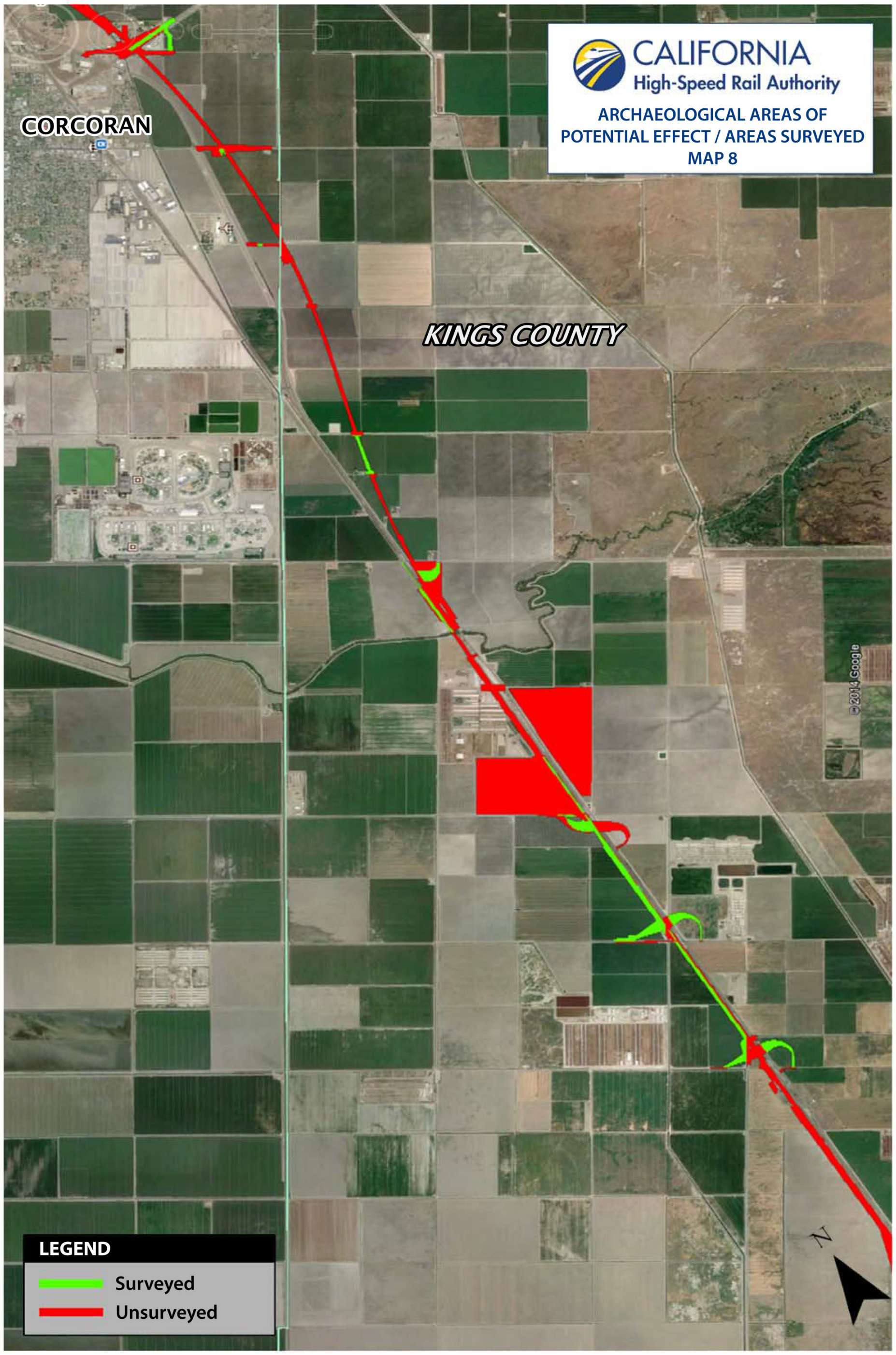
KINGS COUNTY
LEGEND
Surveyed
Unsurveyed
N



CALIFORNIA
High-Speed Rail Authority
ARCHAEOLOGICAL AREAS OF POTENTIAL EFFECT / AREAS SURVEYED
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KINGS COUNTY
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Unsurveyed
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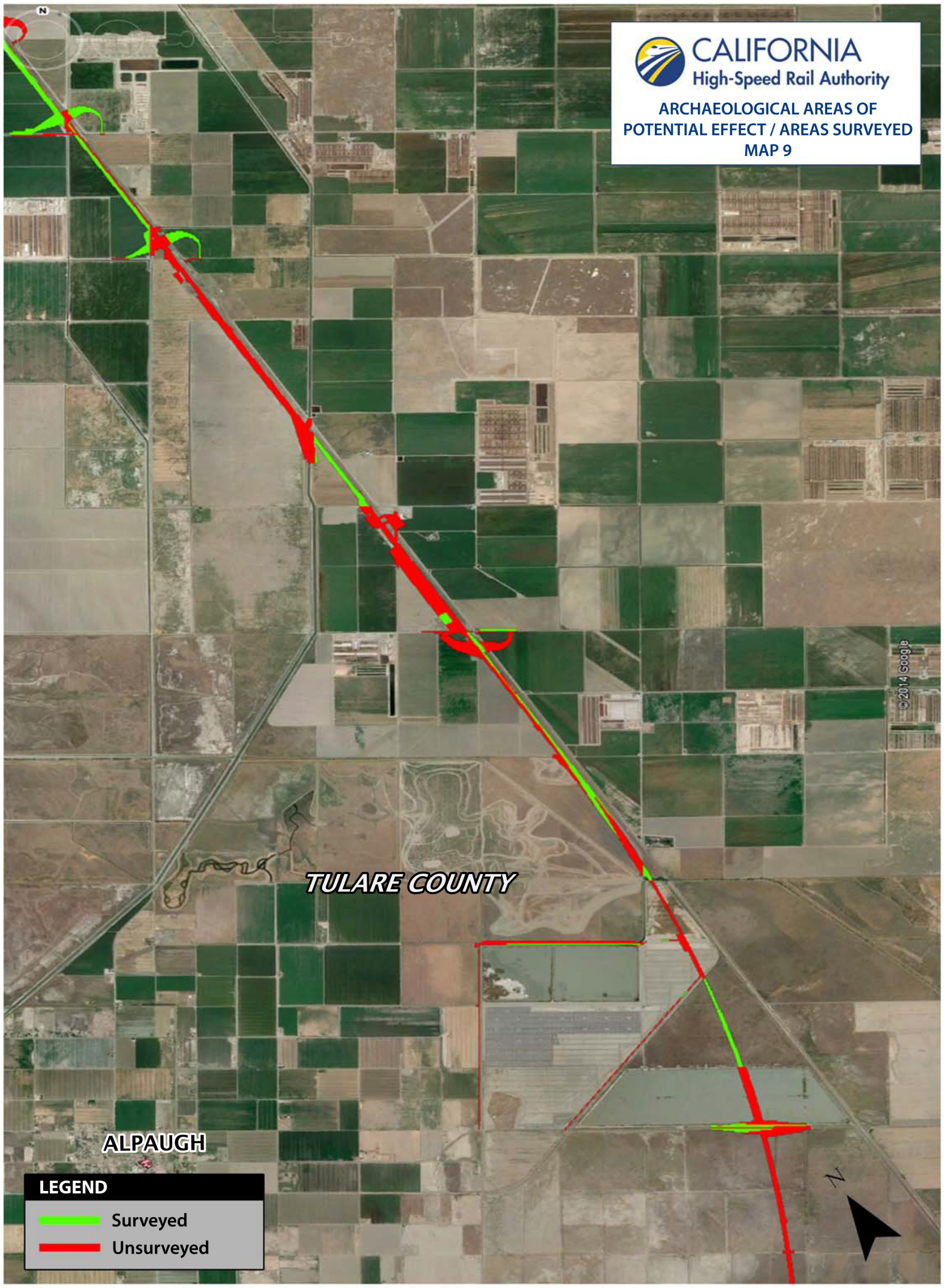

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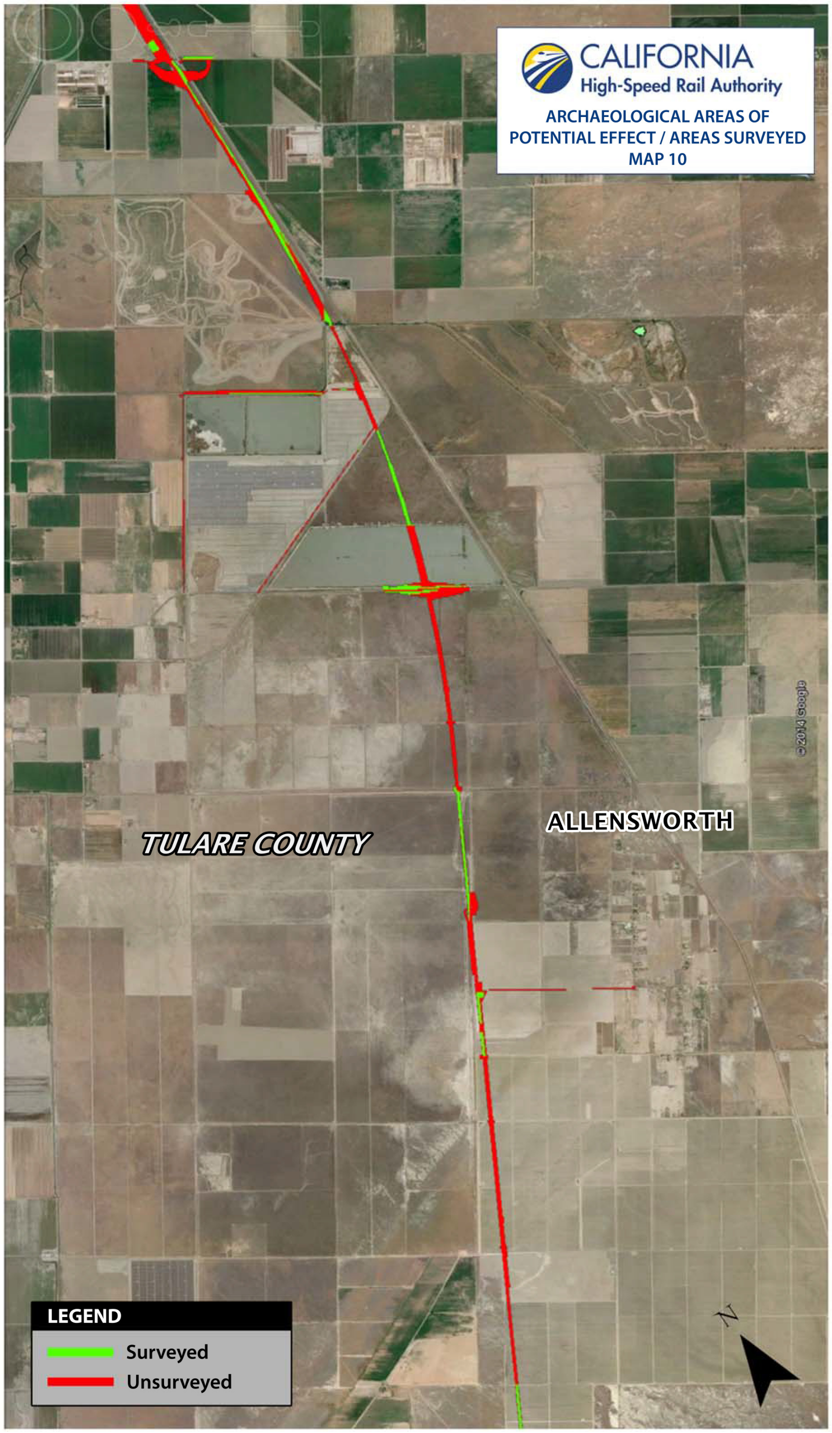

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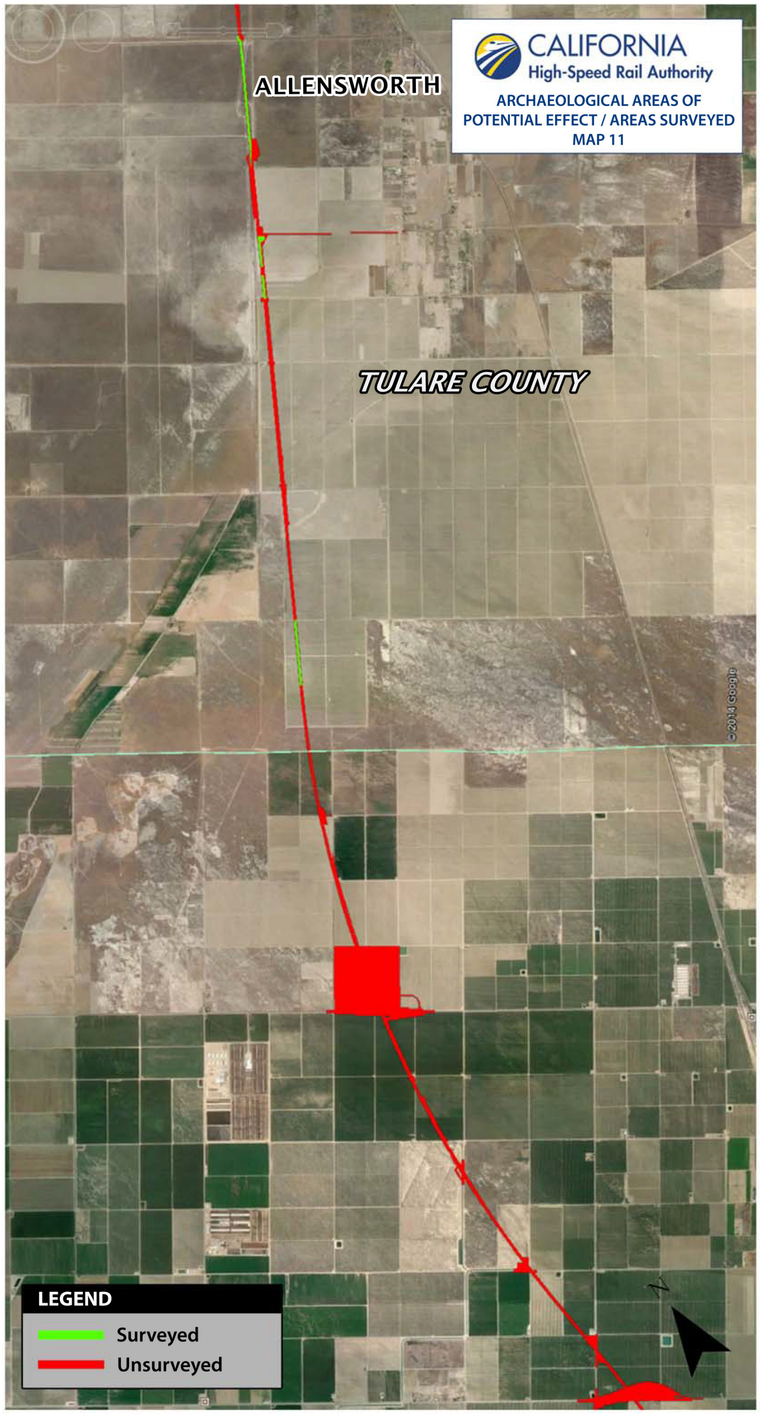

CALIFORNIA
High-Speed Rail Authority
ARCHAEOLOGICAL AREAS OF
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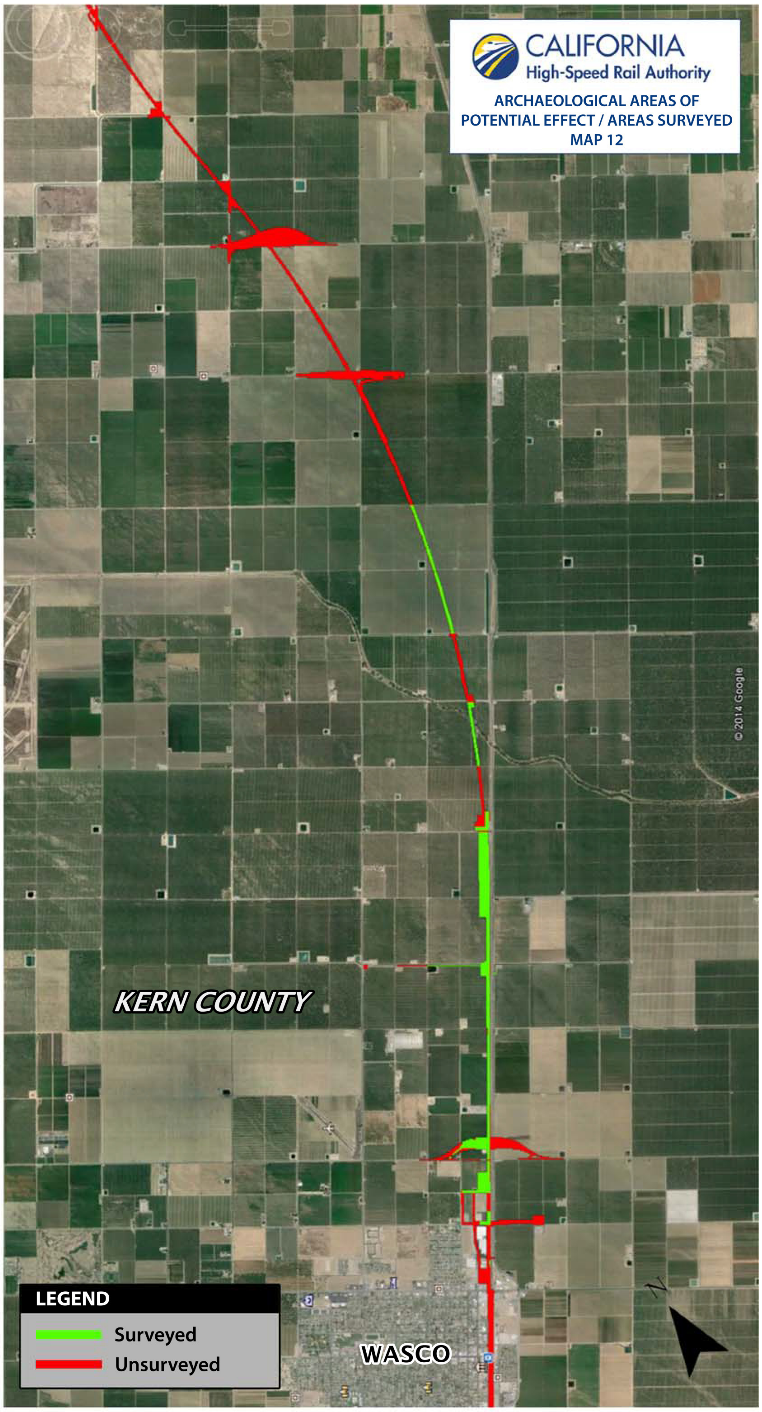
TULARE COUNTY
LEGEND
Surveyed
Unsurveyed
N
© 2013 Google


CALIFORNIA
High-Speed Rail Authority
ARCHAEOLOGICAL AREAS OF
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© 2014 Google
KERN COUNTY
LEGEND
Surveyed
Unsurveyed
WASCO
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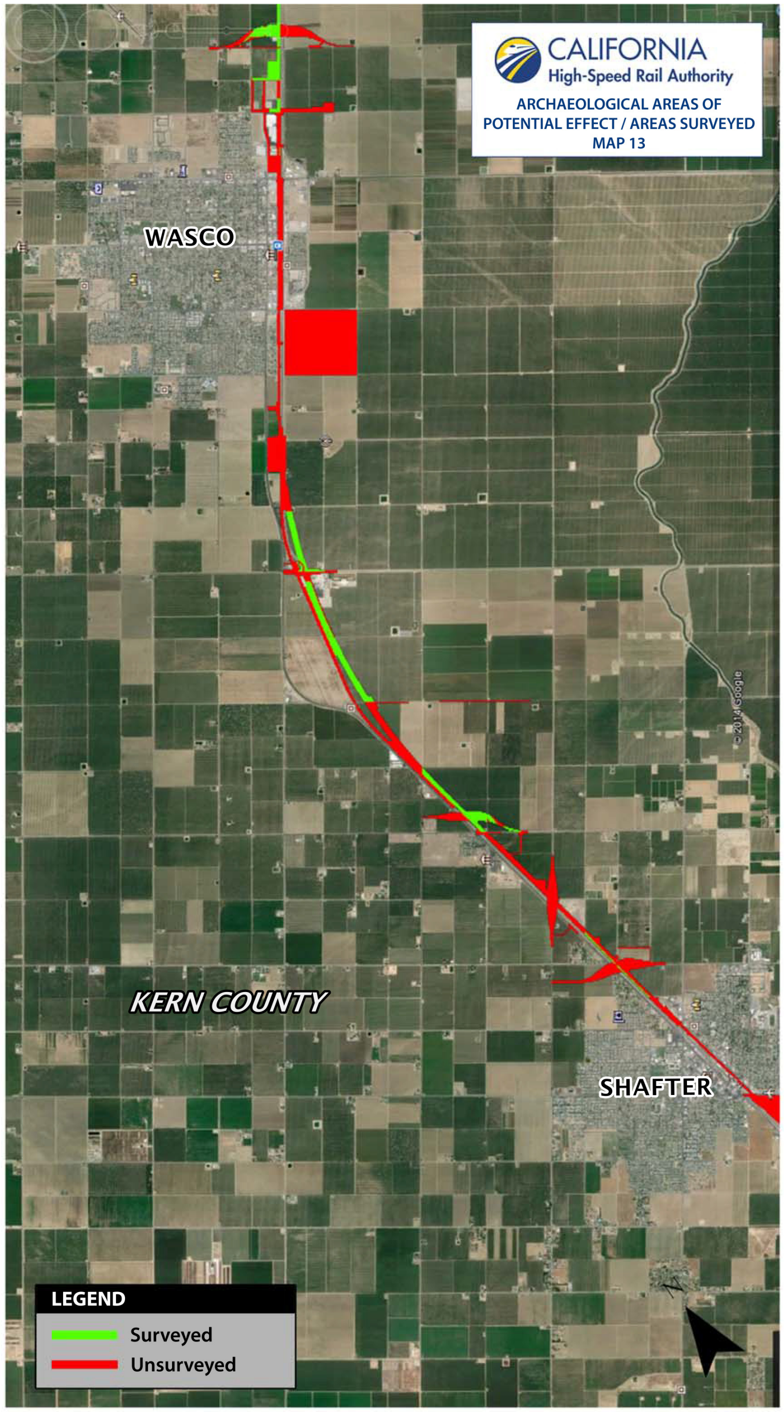

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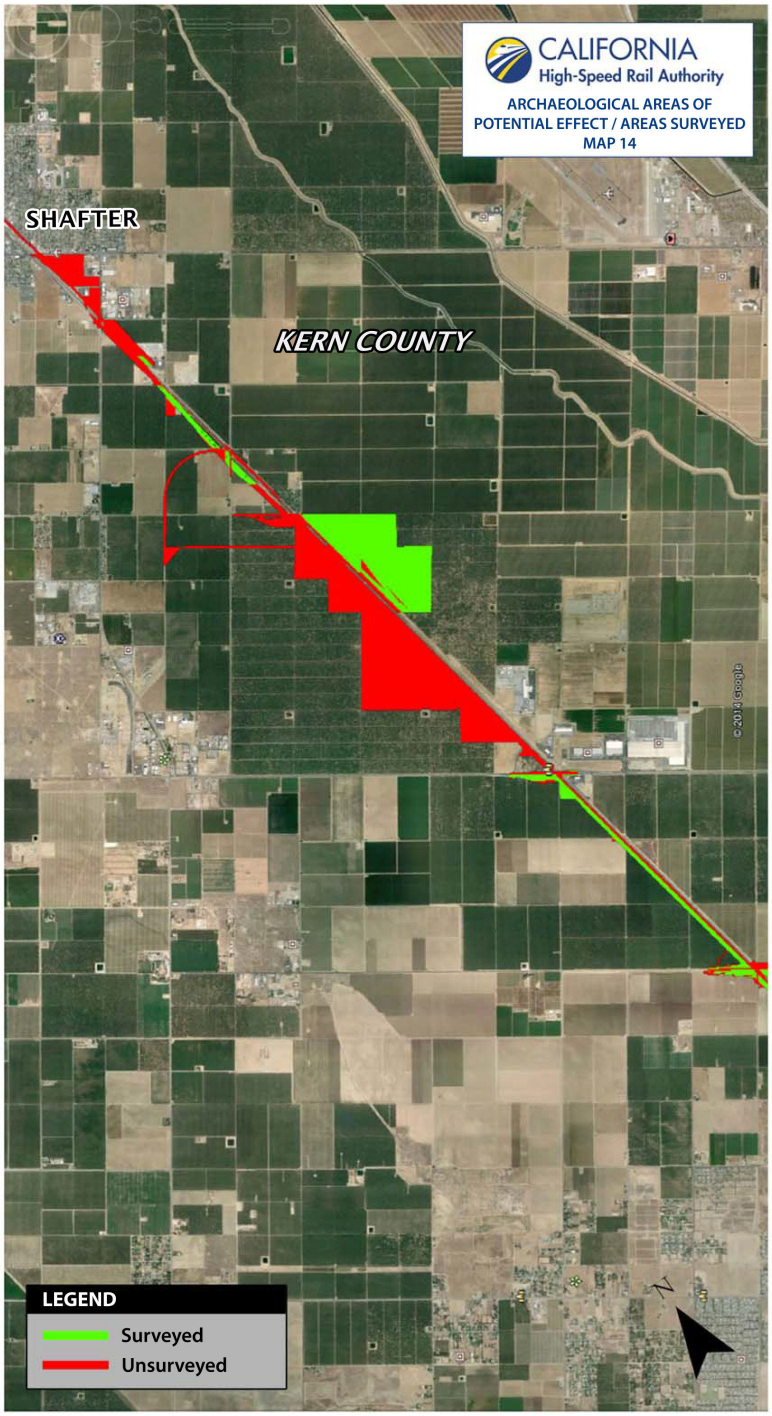
CALIFORNIA
High-Speed Rail Authority
ARCHAEOLOGICAL AREAS OF
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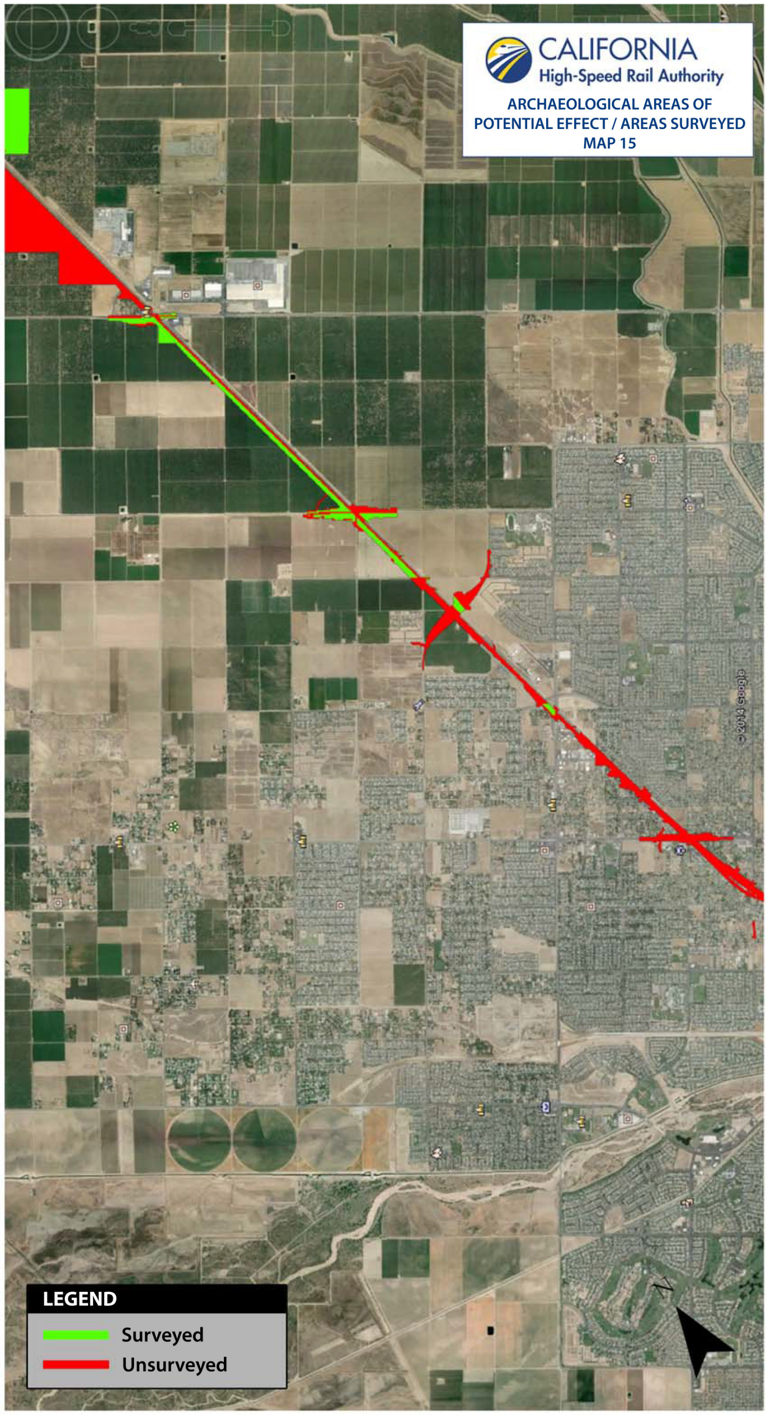
SHAFTER
KERN COUNTY
© 2014 Google
LEGEND
Surveyed
Unsurveyed
N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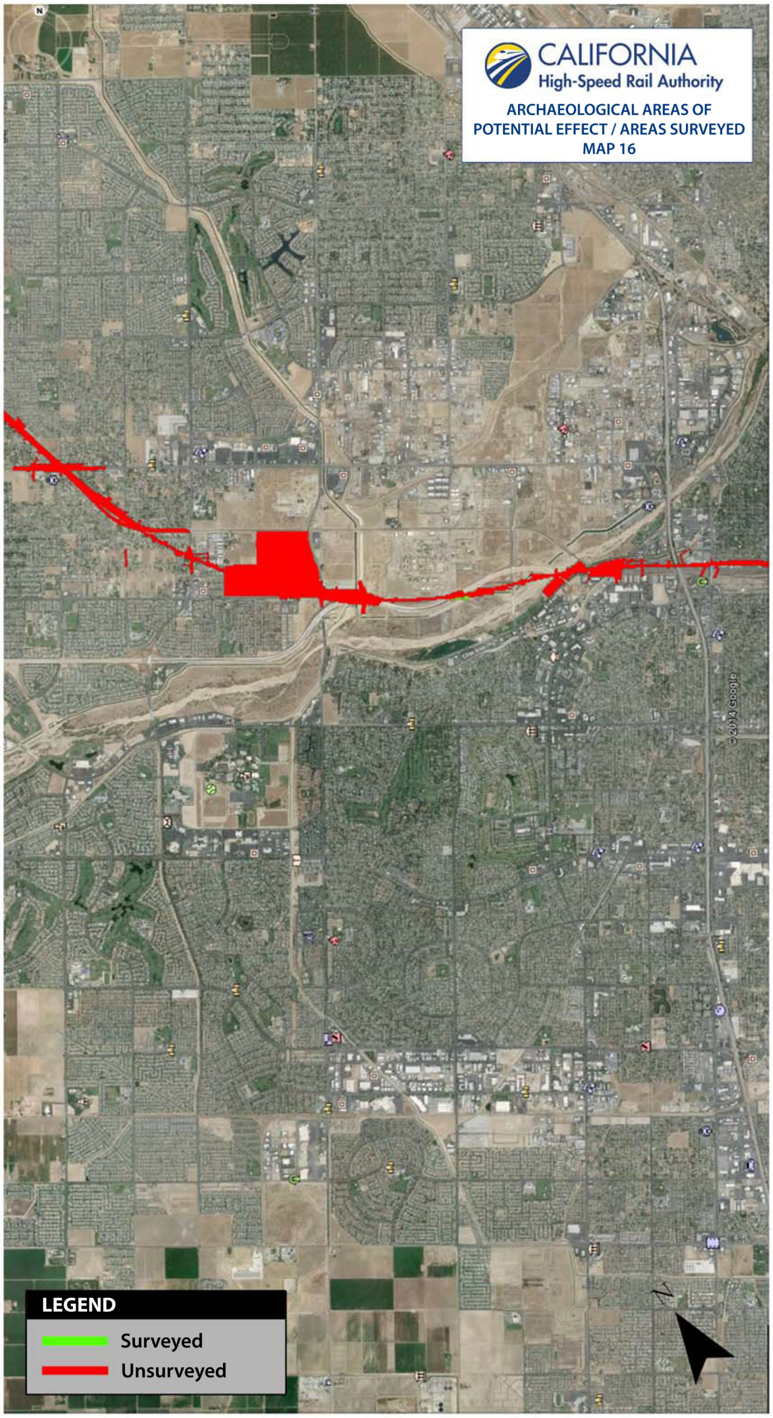
Surveyed
Unsurveyed



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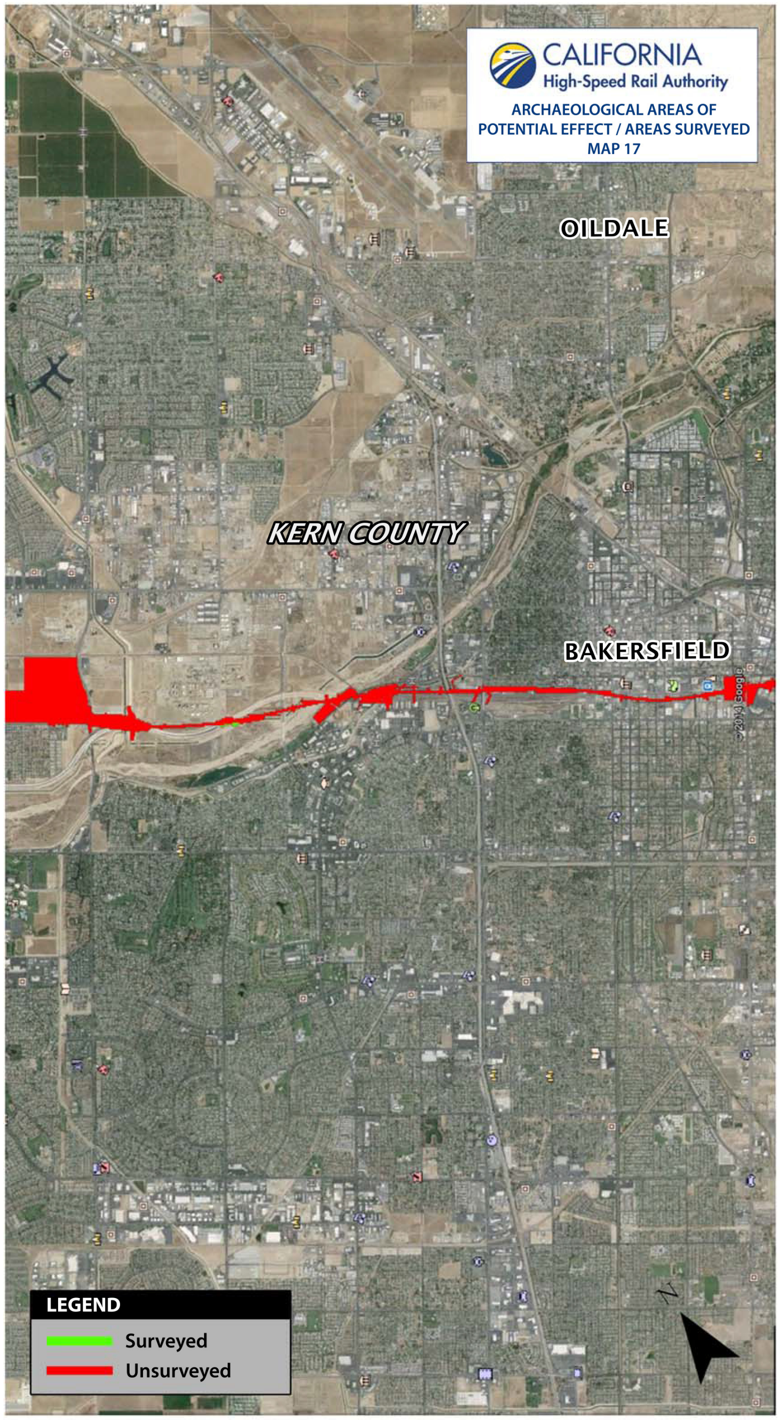

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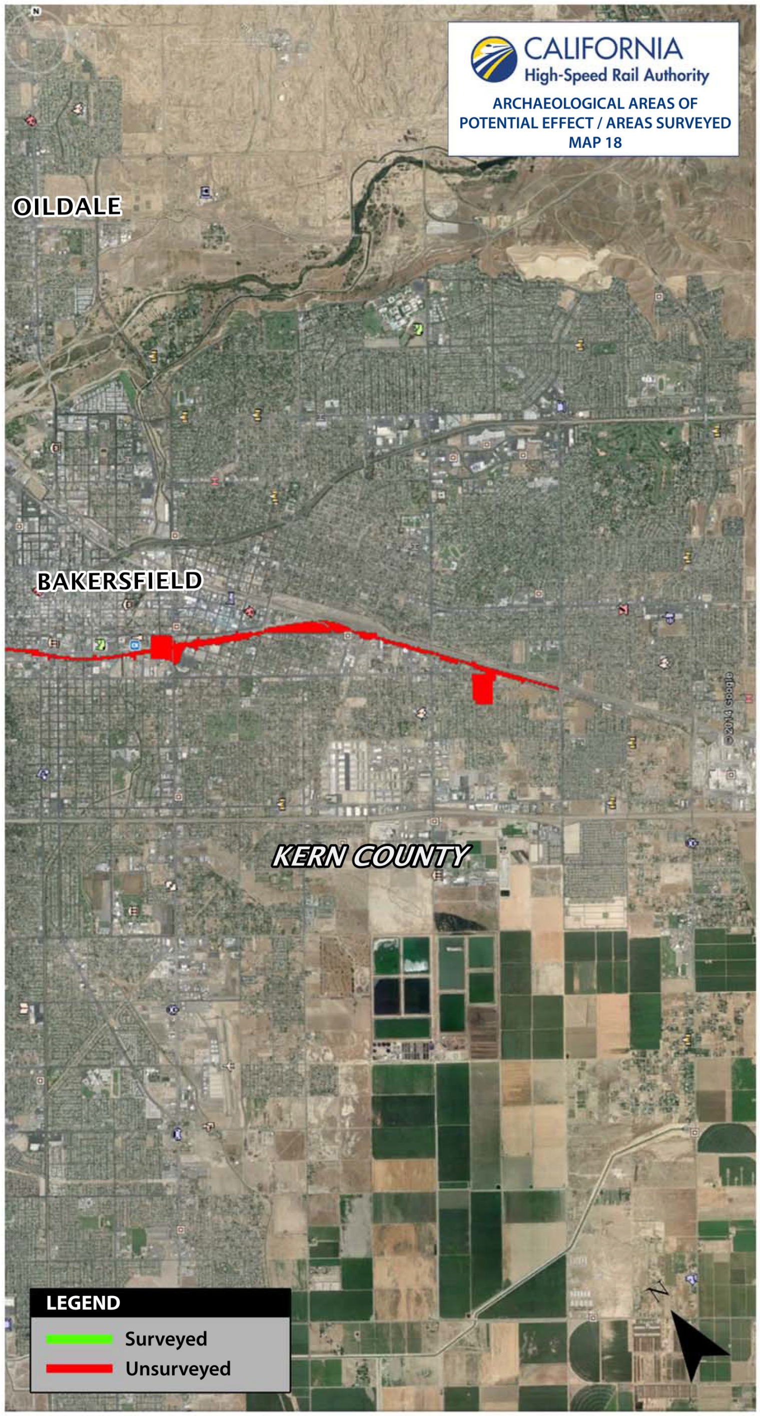

RFP No.: HSR 14-32 - INITIAL RELEASE - 05/27/2015

Attachment B:

Geoarchaeological Investigation Report

CALIFORNIA HIGH-SPEED TRAIN

Project Environmental Impact Report / Environmental Impact Statement

Fresno to Bakersfield

Geoarchaeological Investigation

May 2014

RFP No.: HSR 14-32 - INITIAL RELEASE - 05/27/2015

CALIFORNIA High-Speed Rail Authority

U.S. Department of Transportation Federal Railroad Administration

Geoarchaeological Investigation Technical Report

Prepared by:

URS/HMM/Arup Joint Venture

May 2014

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Acronyms and Abbreviations

AIEP	Fresno to Bakersfield Archaeological Inventory and Evaluation Plan
AMSL	above mean sea level
APE	area of potential effects
ASR	Fresno to Bakersfield Archaeological Survey Report
Authority	California High-Speed Rail Authority
B.P.	before the present
ca.	circa
cal	Calibrated calendar age
Cal-OSHA	California Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CFR	Code of Federal Regulations
EIR	environmental impact report
EIS	environmental impact statement
FRA	Federal Railroad Administration
GIS	geographical information system
GPS	global positioning system
HMF	Heavy Maintenance Facility
HST	high-speed train
ROD	Record of Decision
SJVR	San Joaquin Valley Railroad
Section 106 PA	*Programmatic Agreement among the Federal Railroad Administration, the Advisory Council on Historical Preservation, the California State Historic Preservation Officer, and the California High-Speed Rail Authority Regarding Compliance with Section 106 of the National Historic Preservation Act*
Statewide Program EIR/EIS	*Final Program Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Proposed California High-Speed Train System*
TPSSs	Traction power substations

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Chapter 1.0
Introduction and Summary

1.0 Introduction

This report describes efforts to identify and evaluate the potential for buried cultural resources that may be affected by the California High-Speed Train (HST) Project, Fresno to Bakersfield Section. This work is intended to serve as a supplement to the effort to identify and evaluate archaeological resources described in the *Fresno to Bakersfield Section, Archaeological Survey Report* (ASR)[1] (Authority and FRA 2011a). By the nature of its methods, the ASR was primarily focused on the identification of surface archaeological resources. This current study uses a variety of existing soils, geologic, and archaeological data, as well as a primary field investigation of subsurface conditions, to assess the likelihood for buried archaeological resources not evident during surface inspections—a process known collectively as "geoarchaeology."

Because the HST project is geographically extensive and is being developed in a series of sections, an ongoing effort was made to develop a programmatic agreement (Authority and FRA 2011c), to coordinate all aspects of the cultural resources process and to provide a common format for resource identification, documentation, evaluation, mitigation, and consultation for the project as a whole (Authority and FRA 2011a: Appendix B). The background research and subsurface testing discussed in this Geoarchaeological Investigation report were conducted before the Section 106 Programmatic Agreement (PA) was signed. Consequently, this report conforms to the guidelines established in the *Fresno to Bakersfield Archaeological Identification and Evaluation Plan* (AIEP) submitted and accepted by the California HST Project Management Team and the Authority (Authority and FRA 2011b), as well as in accordance with the Section 106 PA as it was developed during the process of identification presented in this report (Authority and FRA 2011c). No provisions or guidelines are established in the PA for geoarchaeological investigations. Therefore, the methodology employed in the geoarchaeological investigation follows that outlined in the AIEP, and the content of this report follows a logical and best-practice format, consistent with the other cultural resources studies conducted for the Fresno to Bakersfield Section.

1.1 Summary of Findings

Both background research and a primary geoarchaeological field investigation were conducted to assess the potential for the proposed Fresno to Bakersfield Section of the California HST project to affect buried archaeological resources not evident during surface inspections. A brief summary of the project and anticipated impacts are discussed in Section 2, with a more thorough treatment provided in the ASR (Authority and FRA 2011a).

The background research focused on the landscape evolutionary history of the southern San Joaquin Valley, and in particular, the depositional history of the region since prehistoric human populations are believed to have first entered California (circa [ca.] 13,500 years ago). In order to better understand this geomorphic history, published geologic, geomorphic, and soils studies were analyzed for relevant information. In addition, previous archaeological and geoarchaeological studies were used to better understand the problem of buried archaeological sites in the southern San Joaquin Valley. Of particular note in this body of literature is a recent geoarchaeological overview and assessment of California Department of Transportation (Caltrans) Districts 6 and 9, which include the southern San Joaquin Valley, Sierra Nevada, Owens Valley, and northwestern Mojave desert (Meyer et al. 2010). The study provides a comprehensive analysis of the Quaternary depositional, erosional, and hydrologic history of the southern San Joaquin Valley. Based on this analysis, and correlation of mapped surface soil types

[1] A subsequent report was prepared that documented changes to the HST project footprint since the ASR was submitted, *Fresno to Bakersfield Section, Supplemental Archaeological Survey Report*. However, no additional geoarchaeological investigation was conducted for the purposes of the Supplemental ASR.

with known radiocarbon dates and archaeological contexts, the authors developed a weighted geoarchaeological sensitivity model for the region. This regional sensitivity analysis encompasses the entire California HST Fresno to Bakersfield project area, and deals with the problem of buried archaeological sites on a landscape scale directly relevant to the scale of the California HST project. Parts of the sensitivity model are reproduced in this report, with reference to the Fresno-Bakersfield archaeological area of potential effects (APE), as a baseline for determining the potential for the project to affect buried archaeological resources. Background research, including the sensitivity model, is presented in Section 3.

Subsequent to the background research, a field investigation was developed and implemented in order to test the sensitivity model and the assumptions about the Quaternary[2] geomorphology of the region. Given the infeasibility of conducting subsurface investigations for the entire Fresno-Bakersfield archaeological APE, due to its very large extent (over 12,000 acres) and relative lack of parcels with permission to enter, the field investigation was designed as a preliminary assessment in order to develop recommendations to guide future investigations and mitigations. Methodology and results of the field investigation are discussed in Section 4.

The archaeological APE reported in this document reflects the most-current configuration of the project alignments. However, the APE was modified when project engineering issued changes to the project footprint between February and August 2010. The modifications to the APE were made in a manner consistent with the parameters for delineation discussed above. The geoarchaeological field investigation discussed in this report was conducted within the archaeological APE current at the time (December 2010 and March 2011). Changes since that time have caused some of the investigation locations to fall outside of the APE. Nonetheless, these subsurface investigation locations remain useful in assessing the geoarchaeological sensitivity model developed for the Southern San Joaquin Valley (Meyer et al. 2010).

Based on the geoarchaeological sensitivity model (Meyer et al. 2010), approximately 39% of the APE is classified as having High or Very High sensitivity for buried archaeological resources, while only 17% has a Low or Very Low sensitivity. In part, this is due to the geographic location of the Fresno-Bakersfield alignment, which is set on some of the youngest Holocene alluvial sediments in the central portion of the valley, and abuts some of the largest hydrologic features (e.g., Kings River, Tulare Lake, etc.) which would have been very important resources for prehistoric human activities in an environment with very low annual rainfall. In total, 21 trenches and 6 radiocarbon dates were completed for this investigation, primarily in areas considered to have Very High sensitivity for buried archaeological resources. Although no archaeological resources were encountered in any of the trenches, the presence of buried soils (paleosols) in the majority of the trenches, of appropriate age to possibly contain archaeological deposits, largely confirms the sensitivity model. In a few cases, exposed soil profiles and associated dates disproved the presumed sensitivity of a given locale. These combined results are examined in order to modify the sensitivity model, and make recommendations for future investigations and mitigations that will comply with Section 106 of the National Historic Preservation Act requirements to make a reasonable and good faith effort to identify historic properties (36 Code of Federal Regulations [CFR] § 800.4(b)(1)) potentially impacted by the vertical APE of the Project.

[2] The Quaternary Period is composed of the Pleistocene epoch (ca. 1.8 million years ago to 11,700 years before present [B.P.]) and the Holocene epoch (ca. 11,700 B.P. to the present).

Chapter 2
Description of Undertaking

2.0 Description of Undertaking

The Fresno to Bakersfield Section of the High-Speed Train (HST) Project will be 114 miles long. To comply with the Authority's guidance to use existing transportation corridors when feasible, the Fresno to Bakersfield HST Section will primarily be located adjacent to the existing BNSF Railway right-of-way. Alternative alignments were considered and studied throughout the Fresno to Bakersfield Section. The configuration shown in Figure 2-1 represents the combination of alignments that collectively form the preferred alternative for the Fresno to Bakersfield Section.

The Fresno to Bakersfield HST Section will cross both urban and rural lands and include stations in Fresno and Bakersfield, a Kings/Tulare Regional Station in the vicinity of Hanford, and power substations along the alignment. The HST alignment will be entirely grade-separated, meaning that crossings with roads, railroads, and other transport facilities will be located at different heights (overpasses or underpasses) so that the HST will not interrupt nor interface with other modes of transport. The HST right-of-way when at-grade will also be fenced to prohibit public or vehicle access. The project footprint will primarily consist of the train right-of-way, which will include both a northbound and southbound track in an area typically 120 feet wide. Additional right-of-way will be required to accommodate stations, multiple track at stations, maintenance facilities, and power substations.

The Fresno to Bakersfield Section will include at-grade, below-grade, and elevated track segments. The at-grade track will be laid on an earthen rail bed topped with rock ballast; fill and ballast for the rail bed will be obtained from permitted borrow sites and quarries. Below-grade track will be laid in an open or covered trench at a depth that will allow roadway and other grade-level uses above the track. Elevated track segments will span long sections of urban development or aerial roadway structures and consist of reinforced-concrete aerial structures with cast-in-place reinforced-concrete columns supporting the box girders and platforms. The height of elevated track sections will depend on the height of existing structures below, and will be up to 100 feet in height (this is subject to change as design progresses). Columns will be spaced 60 to 120 feet apart.

2.1 Area of Potential Effects Defined

The archaeological APE for this undertaking is defined as the project footprint, which is the area of horizontal and vertical ground disturbance expected during construction of the undertaking. Ground-disturbing activities include grading, cut-and-fill, easements, staging areas, utility relocations, borrow pits, and biological mitigation areas.

Of particular relevance to any geoarchaeological analysis is the degree and nature of proposed subsurface impacts. Unfortunately, given the nature of the design process, the exact location and nature of many of the subsurface impacts are not yet quantified at this time. The current project description indicates that the subsurface disturbance expected for the majority of the project alignment would be to a depth of less than 6 feet. In urban settings, road crossings would be undergrounded to avoid at-grade crossings; however, the exact depths of these undercrossings are unknown at this time. The aerial structures constructed in many areas along the alignment would require piles that would be driven into the subsurface, in some cases 40 to 100 feet below grade. In these instances, the extent of disturbance would be limited to the diameter of the piles, which is currently unknown. Other elements of the project are also likely to result in subsurface disturbance, such as utility corridors, access roads, and laydown areas. The depths of disturbance associated with these elements are not presently known. As planning proceeds, these definitions will be added to the overall APE description.

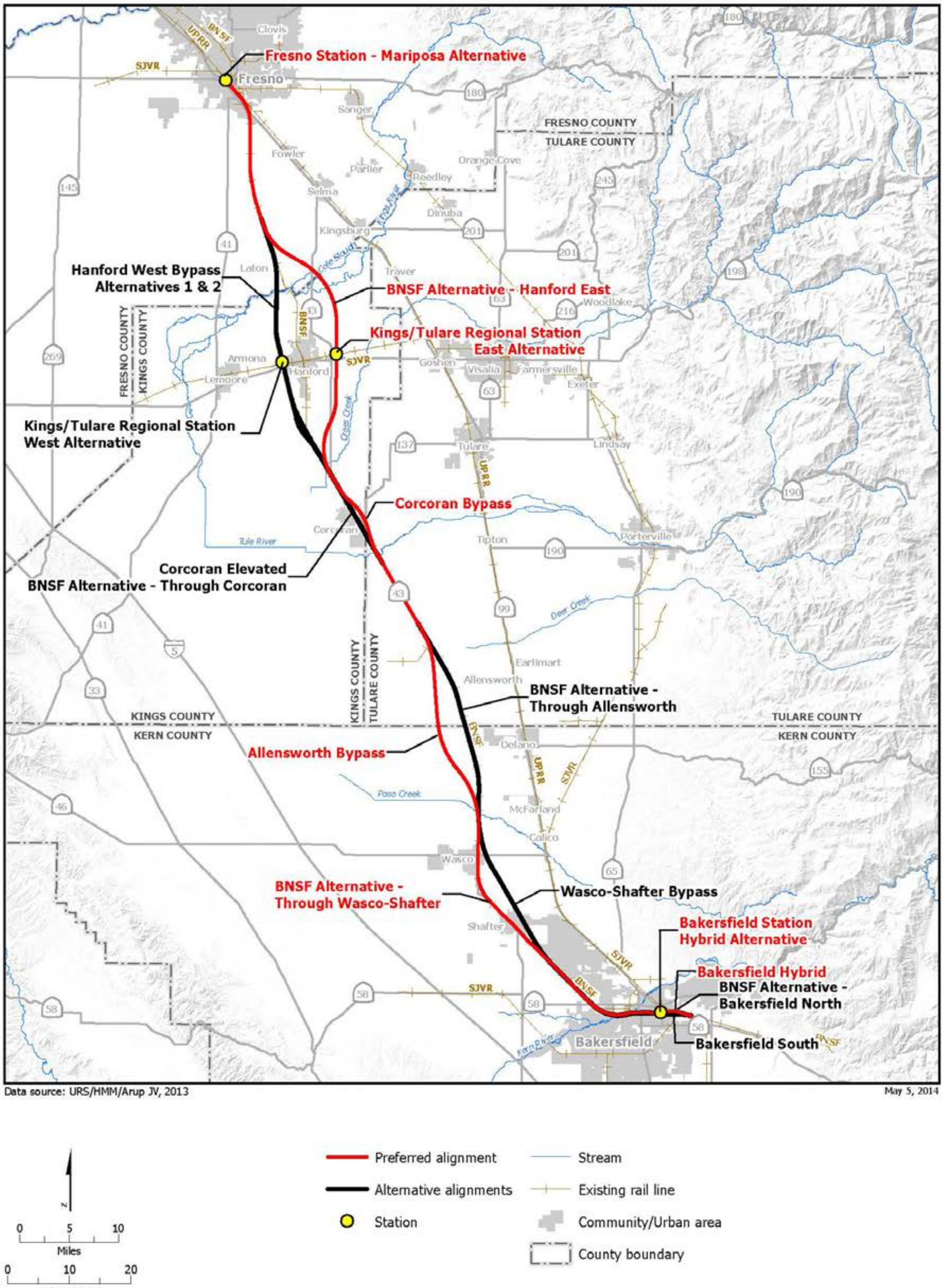

Figure 2-1
Fresno to Bakersfield Preferred Alternative

2.2 Preferred Alternative

The Project EIR/EIS for the Fresno to Bakersfield HST Section examines alternative alignments, stations, and heavy maintenance facility (HMF) sites within the general BNSF Railway corridor. Discussion of the HST project alternatives begins with a single continuous alignment (the BNSF Alternative) from Fresno to Bakersfield, which most closely aligns with the preferred alignment identified in the Record of Decision (ROD) for the Statewide Program EIR/EIS. Descriptions of the additional ten alternative alignments that deviate from the BNSF Alternative for portions of the route then follow. The alternative alignments that deviate from the BNSF Alternative were developed to avoid environmental, land use, or community issues identified for portions of the BNSF Alternative. Please refer Chapter 2 of the Fresno to Bakersfield Section EIR/EIS for detailed descriptions of the project alternatives.

Selection of the Preferred Alternative included consideration of the project purpose and need and the project objectives presented in Chapter 1 of the EIR/EIS, as well as the objectives and criteria in the alternatives analysis, and the comparative potential for environmental impacts. Within the preferred BNSF Railway Corridor for the Fresno to Bakersfield Section, alternative alignments were identified in the Hanford, Corcoran, Allensworth, Wasco-Shafter, and Bakersfield areas. The preferred alignment in each of these areas combine to form the Preferred Alternative from Fresno to Bakersfield, which balances overall impact on the environment and local communities, cost, and constructability constraints of the project alternatives evaluated (Figure 2-1).

The Preferred Alternative combines portions of the BNSF Alternative, Corcoran Bypass, Allensworth Bypass, and the Bakersfield Hybrid. It will extend approximately 114 miles from Fresno to Bakersfield and would lie adjacent to the BNSF Railway route to the extent feasible. The Preferred Alternative will begin at the north end of the Fresno Station tracks and travel southeast through Fresno on the western side of the UPRR until reaching East Jensen Avenue. It will then curve to the south and continue through Fresno County along the BNSF Railway right-of-way in an area consisting mostly of agricultural land. In Kings County, the Preferred Alternative will pass east of the City of Hanford, parallel to and east of SR 43. The Kings/Tulare Regional Station will be located along this alignment, east of SR 43 (Avenue 8) and north of the San Joaquin Valley Railroad (SJVR). South of Hanford, the alignment will curve to the west to rejoin the BNSF Railway right-of-way. At approximately Nevada Avenue, the Preferred Alternative will diverge from the BNSF Railway right-of-way and bypass the City of Corcoran to the east, rejoining the BNSF Railway route at Avenue 136. The Preferred Alternative will continue through Tulare County adjacent to the western side of the BNSF Railway right-of-way until approximately Avenue 56/County Road J 22, where the alignment will diverge from the BNSF Railway and bypass Allensworth Ecological Reserve and the Allensworth State Historic Park to the west. The Preferred Alternative would return to the BNSF Railway right-of-way in the vicinity of Taussig Avenue in rural Kern County, and travel through the cities of Wasco and Shafter. The Preferred Alternative will continue adjacent to the BNSF Railway right-of-way through Bakersfield to the south end of the Bakersfield Station tracks in the vicinity of Baker Street.

Minor deviations from the BNSF Railway corridor are necessary to accommodate engineering constraints, namely wider curves necessary to accommodate the HST (as compared with the existing lower-speed freight line track alignment).

Although the majority of the alignment would be at-grade, the Preferred Alternative would include aerial structures in all of the four counties through which it travels. In Fresno County, an aerial structure would carry the alignment over Golden State Boulevard and SR 99, and a second would cross over the BNSF Railway tracks in the vicinity of East Conejo Avenue. The alignment will also cross Cole Slough and the Kings River on elevated structure.

In Kings County, the Preferred Alternative would be elevated east of Hanford where the alignment would pass over the SJVR and SR 198. The alignment would also be elevated over Cross Creek. In Tulare County, the Preferred Alternative would be elevated at the Tule River crossing and over Deer Creek and the Stoil railroad spur that runs west from the BNSF Railway mainline. In Kern County, the BNSF Alternative would be elevated through the cities of Wasco, Shafter, and Bakersfield. The Preferred Alternative would be at-grade through the rural areas between these cities.

The Preferred Alternative's cross sections include provisions for a 102-foot separation of the HST track centerline from the BNSF Railway track centerline, as well as separations that include swale or berm protection, or an intrusion protection barrier (wall) where the HST tracks are closer. A 102-foot separation between the centerlines of BNSF Railway and HST tracks is provided wherever feasible and appropriate. In urban areas where a 102-foot separation could result in substantial displacement of businesses, homes, and infrastructure, the separation between the BNSF Railway and HST was reduced. The areas with reduced separation require protection to prevent encroachment on the HST right-of-way in the event of a freight rail derailment. The use of a swale, berm, or wall protection would depend on the separation distance.

2.2.1 Preferred Station Alternatives

The Fresno to Bakersfield HST Section would include stations in Fresno, Bakersfield, and a third station, the Kings/Tulare Regional Station.

Stations would be designed to address the purpose of the HST, particularly to allow for intercity travel and connection to local transit, airports, and highways. Stations would include the station platforms, a station building, and associated access structure, as well as lengths of bypass tracks to accommodate local and express service at the stations. All stations would contain the following elements:

- Passenger boarding and alighting platforms.
- Station head house with ticketing, waiting areas, passenger amenities, vertical circulation, administration and employee areas, and baggage and freight-handling service.
- Vehicle parking (short-term and long-term) and "kiss-and-ride."[3]
- Motorcycle/scooter parking.
- Bicycle parking.
- Waiting areas and queuing space for taxis and shuttle buses.
- Pedestrian walkway connections.

Fresno Station

The Fresno Station is located in Downtown Fresno, less than 0.5 mile east of SR 99 on the BNSF Alternative. The station would be centered on Mariposa Street and bordered by Fresno Street on the north, Tulare Street on the south, H Street on the east, and G Street on the west. The station and associated facilities would occupy approximately 20.5 acres, including 13 acres dedicated to the station, short term parking, and "kiss-and-ride" passenger drop-off areas. The site proposal includes the potential for up to three parking structures occupying a total of 5.5 acres.

On May 3, 2012, the Merced to Fresno Section Final EIR/EIS was certified and this Fresno station location was selected. The FRA issued a ROD which included this station site in September of 2012.

[3] "Kiss-and-ride" refers to the station area where riders may be dropped off or picked up before or after riding the HST.

Kings/Tulare Regional Station

The Kings/Tulare Regional Station would be located east of SR 43 (Avenue 8) and north of the SJVR on the Preferred Alternative. The station building would be approximately 40,000 square feet with a maximum height of approximately 75 feet. The entire site would be approximately 25 acres, including 8 acres designated for the station, bus transit center, short-term parking, and kiss-and-ride. An additional approximately 17.25 acres would support a surface parking lot with approximately 2,280 spaces.

Bakersfield Station

The Bakersfield Station will be located at the corner of Truxtun and Union Avenue/SR 204. The station design includes an approximately 57,000 square-foot main station building and an approximately 5,500 square-foot entry concourse located north of the BNSF Railway right-of-way. The station building would have two levels with a maximum height of approximately 75 feet. The first floor would house the concourse, and the platforms and guideway would be on the second floor. Additionally, a pedestrian overcrossing would connect the main station building to the north entry concourse across the BNSF right-of-way. The entire site would be approximately 24 acres, with 15 acres designated for the station, bus transit center, short-term parking, and kiss-and-ride areas. Approximately 4.5 of the 24 acres would support three parking structures with a total capacity of approximately 4,500 cars.

2.3 Power

Power for the HST System would be drawn from California's electricity grid and distributed to the trains via an overhead contact system. The project would not include the construction of a separate power source, although it would include the extension of power lines to a series of power substations positioned along the HST corridor. The transformation and distribution of electricity would occur in three types of stations:

- Traction power substations (TPSSs) transform high-voltage electricity supplied by public utilities to the train operating voltage. TPSSs would be sited adjacent to existing utility transmission lines and the HST right-of-way, and would be located approximately every 30 miles along the route. Each TPSS would be 200 feet by 160 feet.
- Switching stations connect and balance the electrical load between tracks, and switch power on or off to tracks in the event of a power outage or emergency. Switching stations would be located midway between, and approximately 15 miles from, the nearest TPSS. Each switching station would be 120 feet by 80 feet and be located adjacent to the HST right-of-way.
- Paralleling stations, or autotransformer stations, provide voltage stabilization and equalize current flow. Paralleling stations would be located every 5 miles between the TPSSs and the switching stations. Each paralleling station would be 100 feet by 80 feet and located adjacent to the HST right-of-way.

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Chapter 3.0

Geomorphic Setting and Geoarchaeological Sensitivity

3.0 Geomorphic Setting and Geoarchaeological Sensitivity

This chapter consists of a description of the ecological, geographic, and geomorphic setting. This information is used in a geoarchaeological framework to assess the potential for buried archaeological resources within the California HST archaeological APE.

3.1 Natural Setting

The study area for the Fresno to Bakersfield Section of the California HST is at the southern end of California's San Joaquin Valley. The San Joaquin Valley is bounded by the Sacramento–San Joaquin River Delta to the north, the Sierra Nevada to the east, the Tehachapi Mountains to the south, and the Coast Range to the west. The western slope of the Sierra Nevada is the source for rivers and streams that cross the San Joaquin Valley (Gronberg et al. 1998). The San Joaquin Valley is divided into two hydrologic sub-basins: (1) the San Joaquin sub-basin to the north; and (2) the Tulare sub-basin to the south. Rivers of the San Joaquin sub-basin join the San Joaquin River as it drains into the Sacramento River, flowing into San Francisco Bay. The rivers of the Tulare sub-basin, from the Kings River south, have no natural perennial surface outlet, and in the past, formed large, shallow, semi-permanent inland lakes. Only in years of exceptional rainfall did water cross the divide and enter the San Joaquin sub-basin.

During the Pleistocene era, alluvial fans of the Kings River and Los Gatos Creek formed a ridge that impounded waters to the south of the ridge and formed the Tulare Lake basin. As late as the 1840s, Tulare Lake measured 44 by 22 miles in diameter at high water and covered an area of 760 square miles (Gifford and Schenck 1926:7–8; Miller 1957:171–172). The other major lakes within the basin were Buena Vista and Kern.

Current research by Meyer et al. (2010:77) indicates that the Tulare Lake did not reach its maximal extent (approximately 64 meters elevation) until the latest Holocene (ca. 200 years before the present [B.P.]). This was due to accretion of the lower Kings River Fan, throughout the Holocene, which blocked outflow of the lake to the north. It appears that the shoreline was at 62 meters elevation for much of the late Pleistocene and early to middle Holocene, and again during the late Holocene.

At low water levels, Tulare and Buena Vista lakes (Figure 3-1) were historically separated by a slough, but at higher water levels were connected into one lake. Buena Vista Slough extended from Tulare Lake for 40 miles to Buena Vista Lake, and connected the two (Gifford and Schenck 1926:11). The northern 35 miles of the slough had an average width of 2 to 5 miles, while the lower 5 miles were 80 to 100 feet wide. Generally, the slough stuck to the eastern margins of the western foothills, and the swampy areas spread out to the east (Gifford and Schenck 1926:11).

About 12 miles south of Tulare Lake is Goose Lake, formed by a depression in the marshes that formed a lake even during low waters. To the south of Goose Lake is Jerry or Goose Lake Slough, which extends 25 to 30 miles to where it connects with the Kern River, approximately 6 miles west of Bakersfield.

Extensive marshes once surrounded the lakes, sloughs, and rivers. Before the historic period, their size varied seasonally. Plants such as tules (*Scirpus lacustris*), growing as tall as 10 to 12 feet, covered the entire range of the wetlands. On drier ground, vegetation consisted of sagebrush (*Artemesia* spp.), greasewood (*Purshia tridentate*), saltbush (*Atriplex* spp.) and various bunchgrasses. Few trees inhabited the area except for along river channels, and included cottonwood (*Populas fremontii*), sycamore (*Platanus racemosa*), and willow (*Salix* spp.). Figure 3-1 provides a generalized map of reconstructed native vegetation communities at the time of Euro-American entry into California (after Kuchler 1977). Wildlife abounded in the lake and marshlands, where large numbers of migratory ducks and geese joined thousands of year-

round aquatic birds. Freshwater mussel (*Margaritifera margaritifera*), fish, and turtles were abundant, along with pronghorn antelope (*Antilocapra americana*), tule elk (*Cervus elaphus*), and winter herds of mule deer (*Odocoileus hemionus*). The area was also home to plentiful numbers of rabbit (*Sylvilagus* spp.), black-tailed hare (*Lepus californicus*), and valley quail (*Lophortyx californica*) (Wallace 1978:449). The variety of wildlife in the southern San Joaquin Valley was typical for an area characterized by an arid to semi-arid climate, defined by hot summers and mild winters.

The southern San Joaquin Valley has undergone substantial and widespread ecological change since the arrival of Euro-Americans into the area in the early and middle nineteenth century. Channeling of the Kern River for agricultural purposes began in the 1850s, decreasing water flow into lakebeds and accelerating rates of evaporation for Tulare, Buena Vista, and Kern lakes. As the lakes shrank and eventually disappeared, the lakebeds were quickly reclaimed for agricultural purposes. Buena Vista Lake, which continued to receive minimal amounts of water for a longer period of time, was used as a reservoir until approximately 1950, when it too disappeared, and was developed as farmland (Wedel 1941:7 in Hartzell 1992:62). Today, the area bears little resemblance to its prehistoric appearance. Plant and animal populations have significantly decreased in number and diversity, and only 4% of the former wetlands remain within the southern San Joaquin Valley (Crampton 1974; Hartzell 1992; Munz 1968).

In addition to these considerations, the project area has been almost exclusively dominated by agricultural activities during the historic period. This means that there is a generally low probability of encountering buried historic-era archaeological sites, unlike in more urbanized settings, where progressive development can obscure historic-era archaeological resources. This agricultural activity, however, has had a very dramatic impact on the natural environment and soils. Extensive grading of the southern San Joaquin Valley over the past 150 years has resulted in the disturbance, removal, and redisposition of native soils. With regard to the potential for buried prehistoric archaeological sites, this historic land use suggests the possibility of the complete removal and destruction of archaeological sites, as well as the potential for artificial burial of sites under imported fill.

3.2 Geomorphic Setting and Geoarchaeological Assessment

The purpose of this geoarchaeological analysis is to determine the potential for the California HST project to cause adverse effects to archaeological resources that are not evident on the surface and, as such, would not be identified through conventional reconnaissance surveys. This effort helps to ensure that FRA has made a reasonable and good-faith effort to meet its Section 106 responsibilities to identify historic properties potentially affected by the project. Additionally, the geoarchaeological assessment effort seeks to avoid costly delays that may occur when resources are discovered after project construction has begun, and late-discovery protocols become necessary.

The relationship between archaeological sites and environmental context has long been recognized as important in understanding and interpreting the archaeological record. However, in California, the relationship between landscape evolution over time and the differential exposure and burial of archaeological sites has only begun to emerge as a significant research agenda (e.g., Meyer 1996). Before the last decade, archaeological studies of landscape formation have largely been ad hoc, after the discovery of buried archaeological material.

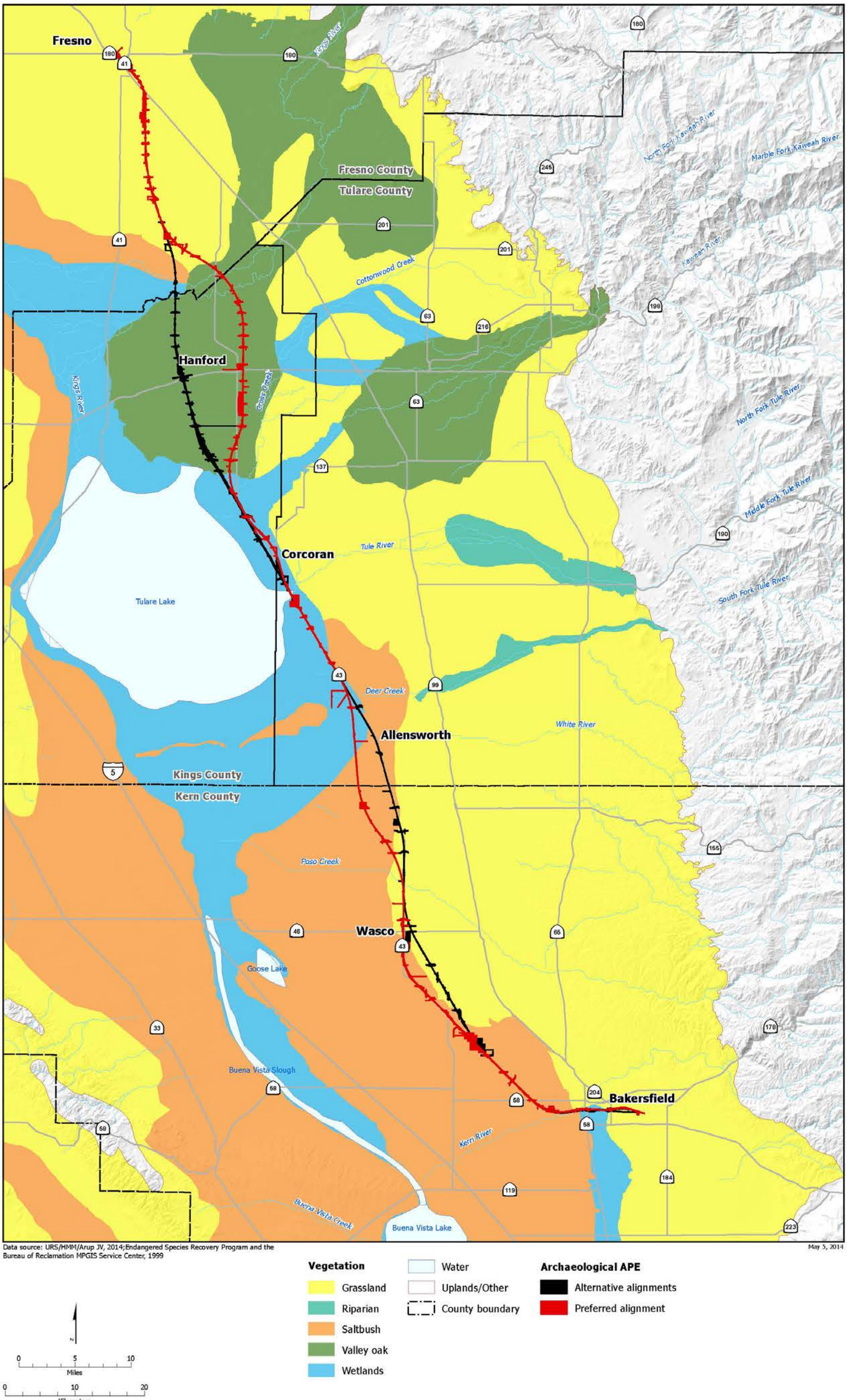

Figure 3-1
Historic natural vegetation and hydrology

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As a result of the dynamic nature of California's landscape, archaeological sites deposited over the last ca. 13,500 years (roughly the time that humans are known to have lived in California) have been subject to numerous geomorphic processes that have either buried, destroyed, or left these sites intact on the surface. Within the San Joaquin Valley, these geomorphic processes include the response of alluvial fan deposition to changing climate; fluctuating river courses and related floodplain deposition; the response of lakes (i.e., Tulare, Buena Vista) to climate; and the response of the San Joaquin River to sea-level rise and upstream effects of the formation of the San Joaquin Delta. All of these factors have likely affected the differential preservation of archaeological sites on the surface and the ability to accurately assess the effects of the California HST project solely through archaeological reconnaissance surveys, which are necessarily limited to investigation of the modern ground surface.

To assess the potential for buried archaeological sites within the proposed project components for the California HST, this study takes into account factors that either encouraged or discouraged human use or occupation of certain landforms (e.g., geomorphic setting and distance to water), combined with those that affected the subsequent preservation (i.e., erosion or burial) of those landforms. It is well known, for instance, that prehistoric archaeological sites in California are most often found on relatively level landforms near natural water sources (e.g., spring, stream, river, or estuary), which is often where two or more environmental zones (ecotones) are present (Beardsley 1954:64; Foster and Sandelin 2003:4; Jackson 1988; Pilgram 1987). Landforms with this combination of variables are frequently found at or near the contact between a floodplain and a higher and older geomorphic surface, such as an alluvial fan or stream terrace (Hansen et al. 2004:5).

As with surface sites, buried archaeological sites are not distributed randomly throughout the landscape, but occur in specific geo-environmental settings (Rosenthal and Meyer 2004a). For example, fans and floodplains regularly contain buried archaeological deposits, indicating some relationship between these landforms and past settlement activities. In the southern Santa Clara Valley, for example, it was found that most previously unidentified buried sites tend to be close to present stream channels (generally less than 200 meters, or 656 feet), as well as abandoned stream channels (Rosenthal and Meyer 2004a:76). Thus, an increased potential exists for buried prehistoric archaeological sites in those areas where Holocene-age depositional landforms are near past or present water sources.

In general, most Pleistocene-age landforms have little potential for harboring buried archaeological resources, because they developed before the first evidence of human migration into North America (ca. 13,500 years BP). However, Pleistocene surfaces buried below younger Holocene deposits do have a potential for containing archaeological deposits. Holocene alluvial deposits may contain buried soils (paleosols) that represent periods of landform stability before renewed deposition. The identification of paleosols within Holocene-age landforms is of particular interest because they represent formerly stable surfaces that have a potential for preserving archaeological deposits.

The problem of buried archaeological sites within the San Joaquin Valley, and more generally, the Central Valley as a whole, was recently summarized as such:

> The Central Valley's archaeological record, as it is known today, is biased by natural processes of landscape evolution. Surface sites are embedded in young sediments set within a massive and dynamic alluvial basin, while the majority of older archaeological deposits have been obliterated or buried by ongoing alluvial processes. Consequently, archaeologists have had to struggle to identify and explain culture change in portions of the Central Valley where available evidence spans only the past 2,500 years or, in rare cases, 5,500 years. (Rosenthal et al. 2007:150)

Although the assumption that surface sites exist only on younger sediments is not necessarily accurate, the general problem of site visibility in a region that has been geomorphically dynamic over the past 13,500 years—roughly the period of human occupation in California—is highly relevant to the California HST project.

Geomorphic processes have played a major role in the differential preservation of archaeological sites in the San Joaquin Valley. Paleo-Indian sites (ca. 13,500–10,500 B.P.) and Lower Archaic sites (ca. 10,500–7500 B.P.) are extremely rare throughout the Central Valley. As discussed in the ASR (Authority and FRA 2011a) , these early sites are typified by sparse lithic remains, often around the edges of late Pleistocene to early Holocene lakes, including nearby Tulare, Buena Vista, and Goose lakes (Wallace and Riddell 1991, Dillon et al. 1991; Porcasi 2000; Fredrickson 1986). The end of each of these periods was marked by significant episodes of deposition—particularly at ca. 11,000 and 7500 B.P.—which covered and/or eroded the existing landforms (Rosenthal et al. 2007). Studies throughout northern California suggest that a period of relative landscape stability was followed by another episode of deposition ca. 2800 B.P. However, other indications are that late Holocene landscape changes tend to be more localized and dependent on local variability in climate and precipitation, than are the more regional depositional trends documented for the earlier Holocene and Pleistocene (Meyer and Rosenthal 2007:7-8).

3.2.1 Geologic and Geomorphic Setting

The central area and eastern side of the San Joaquin Valley, through which the proposed California HST project rights-of-way run, are dominated by a complex intermingling of basin deposits that dominate the valley floor, and by large alluvial fans that issue from the foothills of the Sierra Nevada and extend across the valley. This geomorphic contact is a geologically and seismically active area, and this activity has had a direct effect on surface geomorphology, deposition, and soils.

The San Joaquin Valley is a deep structural trough that was a large marine embayment (i.e., open to the ocean) during much of its geologic history. The trough became progressively closed off during Pliocene times (ca. 5 million years ago) as a result of the uplift and movement along the San Andreas fault zone, causing a transition from a marine to terrestrial depositional environment. This trend continued until the Pleistocene, when the valley was finally completely closed off from its outlet through Priest Valley (near Coalinga) and very thick alluvial fan deposits like the Tulare Formation and Kern River Formation (see below) completed the infilling of the valley. Episodic alluvial sedimentation in the San Joaquin Valley throughout the Quaternary probably has been controlled more by climatic fluctuations than by tectonic activity, though both have played a role (Bartow 1991:7–9).

The Sierra Nevada range flanks the eastern side of the San Joaquin Valley, several miles east of the project APE. The climate of this large mountain range, with significant precipitation—primarily in the form of winter snow— is in stark contrast to that of the adjacent valley, which has a semi-arid climate that receives between 5 and 10 inches of rain each year across the APE. The large rivers and streams that drain the Sierra Nevada and cross the eastern San Joaquin Valley contrast with the surrounding semi-arid environment, and provide unique resources for human exploitation, as well as significant amounts of sediment that affect landscape formation. These drainages have apparently maintained a consistent but dramatically fluctuating discharge for much of the late Pleistocene and Holocene, building a series of large alluvial fans along the western flank of the Sierra Nevada.

3.2.2 Models of Landscape Development

Until recently, the primary model of alluvial landform development within the eastern San Joaquin Valley has been inherently linked to cycles of glaciation in the Sierra Nevada. The basic theory

holds that the sediment necessary to create the large alluvial fans flanking the western slope of the Sierra was created during glacial maxima and made available for transport through glacial scouring, and that such transport occurred soon thereafter. As drainages swelled with melting glacial waters, reduced vegetation cover resulting from a warmer, drier climate allowed the stripping of sediment from upslope, and the sediment was transported to the valley (Weissmann et al. 2005:182). This theory presumes that the majority of the sediments that make up the large fans along the eastern San Joaquin Valley date to the late Pleistocene—soon after the last glacial maximum at ca. 15,000 B.P., or earlier (i.e., related to previous glacial events). These late Pleistocene deposits are represented by the Modesto Formation, which is depicted and referenced in numerous seminal geology and geomorphology studies of the eastern San Joaquin Valley (Arkley 1962; Marchand and Allwardt 1981; Page 1986; Weissmann et al. 2005; Bennett et al. 2006).

However, as Meyer, Rosenthal, and Young (Meyer et al. 2010:16) point out, "few attempts have been made to actually demonstrate that glacial periods in the Sierra Nevada correlate with the age of alluvial deposits (in the San Joaquin Valley) presumed to derive from these cycles." This correlation, or lack thereof, is key to the potential for buried archaeological sites within the California HST archaeological APE. If most of the landforms associated with the eastern San Joaquin Valley alluvial fans formed during the late Pleistocene, then they pre-date the entry of humans into California, and as such, are very unlikely to contain buried archaeological resources. On the other hand, if the glacial model is incorrect, the existing models of eastern San Joaquin Valley fan development may seriously underestimate the potential for buried archaeology.

3.2.3 Hydrology and Paleoclimate

Despite the lack of precipitation in the study area, several large lakes occupied the southern San Joaquin Valley throughout the late Pleistocene and Holocene (Figure 3-1). The largest of these lakes was Tulare Lake, just west of the APE. The Tulare Basin is dammed by the coalescent alluvial fans of the Kings River, draining the Sierra Nevada and feeding south into the basin, and Los Gatos Creek draining the Coast Ranges and feeding north into the San Joaquin River aquifer. Tulare Lake declined rapidly after 1850, when the Kings River (and other tributary streams) began to be diverted for irrigation.

At its maximum historical extent, Tulare Lake covered an area of approximately 2,000 square kilometers (772 square miles), and had a maximum depth of 10 meters (33 feet) (Davis 1999). In an otherwise semi-arid environment, the Holocene lakes and their shorelines would have provided a rich and diversified ecosystem for prehistoric peoples. Indeed, the attractiveness of this unique resource to people throughout prehistory is evidenced by the presence of archaeological deposits, spanning from Paleo-Indian times (ca. 13,000 B.P.) to the historic era, along the shorelines of Tulare Lake. As discussed in the ASR (Authority and FRA 2011a), all of the prehistoric archaeological resources recorded during the field reconnaissance were near the maximum shoreline of the lake.

South of Tulare Lake, and farther from the APE, is Buena Vista Lake, which—along with the smaller Kern Lake—is fed by the Kern River. The Kern River drains the southern Sierra Nevada, from south of Mount Whitney to its outlet through Kern Canyon, where it enters the San Joaquin Valley at Bakersfield (Figure 3-1). The large alluvial fan associated with the river extends from the foot of the Sierra entirely across the valley to the Elk Hills, forming a broad natural levee across which numerous forks of the river meander, draining partly southward into Buena Vista Lake and partly northward into Goose Lake and the Tulare Basin.

Lying south of the Kern River fan (Figure 3-1) is Buena Vista Basin, measuring about 30 miles from east to west by 20 miles north to south. Its lowest point, which was occupied by Buena Vista Lake, is 268 feet above sea level, with the northern rim just under 300 feet. In historic

times, considerable fluctuations have occurred in the height of water in the lake. In 1910, the shoreline followed the 291-foot contour, and Buena Vista Lake was roughly 8 by 5 miles, with no outlet. At 295 feet or over, Buena Vista and Kern lakes form a single broad sheet, overflowing northwestward around the Elk Hills through Buena Vista Slough into Tulare Basin (Wedel 1941:6). Given the perennial nature of the Kern River, it is unlikely that either of the lakes ever dried up completely during the Holocene (Gifford and Schenck 1926:15). This is confirmed by pollen core analysis conducted at Tulare Lake, which shows that lake levels fluctuated significantly throughout the latest Pleistocene and Holocene, but never fully desiccated (Davis 1999).

Following on this pollen core analysis (Davis 1999), a more recent synthesis of available pollen and pedostratigraphic data from Tulare Lake resulted in a relatively well-defined history of lake highstands and associated environmental perturbations (Negrini et al. 2006). Throughout the late Pleistocene and Holocene, water levels within these lakes and wetlands fluctuated dramatically. At least seven major fluctuations in lake levels during the past 11,500 years have been proposed (Negrini et al. 2006). Lake levels were generally higher during the early Holocene, with two highstands (ca. 220 feet above mean sea level [AMSL]) at 9500 to 8000 B.P. and 6900 to 6200 B.P. After that, the lake fluctuated at lower amplitude until reaching a major highstand during the most recent millennium (ca. 750 to 150 B.P.). At least three lowstands (less than 190 feet AMSL) occurred at the following times: approximately 9700, 6100, and 2750 B.P.

The timing of these lake-level events appears to be correlative with more widespread periods of landscape instability throughout the Central Valley. Several recent reviews of Central Valley geoarchaeology and geomorphology (Rosenthal and Meyer 2004a, 2004b; Rosenthal et al. 2007; Meyer et al. 2010) have identified numerous periods of local depositional events that have buried stable Holocene landforms and associated archaeological sites. Although the timing of many events varies from locale to locale within the valley, several major periods of deposition seem to co-occur throughout the greater region. To assess the relationship between Tulare Lake Basin highstands and wider environmental processes, these major periods of alluvial deposition have been plotted against the lake-level records from Tulare Lake and other well-defined lake records in the southwest (Figure 3-2).

Basic geomorphic dynamics dictate that increased alluvial deposition will occur during wetter periods, when the carrying capacity and sediment load of watercourses are increased (Easterbrook 1999:118). As shown in Figure 3-2, this process is evinced by those periods of deposition that co-occur with the onset of lake highstands (i.e., most notably at ca. 650, 4000, 7000 to 7500, and 11,000 B.P.). However, at least two periods of broad-scale deposition appear to co-occur with the onset of Tulare Lake lowstands and associated environmental desertification (ca. 1300 and 2800 B.P.). These periods suggest that alluvial deposition may also be related to broader environmental perturbations, when reduced vegetation cover may lead to increased erosion of formerly stable landforms.

These multiple periods of alluvial deposition throughout the Holocene raise serious doubts about the efficacy of the glacial model described above. The timing of glacial events—even minor ones such as the “Little Ice Age,” which did not begin its retreat until ca. 400 B.P.—are out of step with the major Holocene depositional episodes documented throughout California and the Central Valley. Aside from the Little Ice Age, all of the most-recent periods of Sierra Nevada glaciation occurred during the Pleistocene. A different model is necessary to explain the periods of Holocene landscape stability and deposition. Some clues to the geomorphic processes at work are evident in the co-occurrence of the onset of lake highstands (as well as the onset of lake desiccation) and depositional events.

The timing of major depositional episodes, shown in Figure 3-2, indicates that landscape instability is associated with periods of climate change, both during transitions to wetter climate,

as well as transitions to drier climate. This suggests that there is an ideal threshold point at which precipitation outstrips the ability of vegetation to stabilize sediment. During periods of low rainfall, vegetation is sparser, but precipitation is not adequate to move the sediment on the surface. Alternatively, during periods of high rainfall, vegetation is dense and stabilizes surface sediments from being transported downslope (Langbein and Schumm 1958; Miller et al. 2004). Therefore, in general, it is during periods of transition from one climatic regime to another that destabilization of sediment and landscape alteration occurs.

The timing of these major climatological events is directly relevant to the potential for buried archaeological deposits within the California HST archaeological APE in two respects: (1) the timing of major broad-scale depositional events within the San Joaquin Valley and nearby Sierra Nevada and Coast Ranges gives an indication about the age of associated archaeological deposits that may potentially exist below successive depositional units within the study area; and (2) local changes in lake and slough water levels would have dramatically affected the extent and productivity of those resources, and thus the spatial relationship of archaeological sites to those resources. Fluctuations in water levels would have undoubtedly resulted in changes in settlement patterns and archaeological site deposition. In conjunction with alluvial depositional and/or erosional fluctuations, these two factors can be expected to largely dictate the placement and preservation of archaeological sites on (and within) the modern landscape.

3.2.4 Project Area Soils and Geoarchaeology

Through correlation of mapped surface soil units, field observations, soil profile descriptions, and radiocarbon dates—compiled from existing studies as well as original fieldwork conducted for Caltrans—Meyer et al. (2010) established a relational database of mapped soil series and landform age for the southern San Joaquin Valley. Their study is largely based on soils data obtained through the Soil Survey Geographic Database (SSURGO), which is a geographical information system (GIS)-based version of various original Soil Conservation Service soil survey maps. A reproduction of this landform-age map, based on the published soil-age database (Meyer et al. 2010), is included here with reference to the APE (Figure 3-3).

The database is predicated on the theory that specific soils types are typically associated with specific depositional environments and landforms of a particular age. The degree of soil profile development provided by official soil series descriptions was used to make initial relative-age estimates. In addition to relative soil development, age estimates were also based on the geomorphic position of associated landforms, crosscutting relationships, degree and extent of erosional dissection, radiocarbon dates, and correlations with other dated deposits (e.g., Rosenthal and Meyer 2004a:76).

In cases where there was disagreement on landform-age assignments between soil surveys and/or other geomorphic studies, a combination of soil profile development, horizontal crosscutting relationships, and radiocarbon dating was used to place similar soil series and landforms into particular temporal groups. This cross-comparison effort eventually resulted in SSURGO soil map units that were consistently associated with landforms that occupy similar geomorphic positions on the landscape. These units could then be grouped into major temporal periods that could be assigned a relative sensitivity for buried archaeological resources. This database and sensitivity model is discussed below, with reference to the Fresno to Bakersfield APE. (For a complete description of methodology used to create the soil-age database, see Meyer et al. 2010:3, 123-128.)

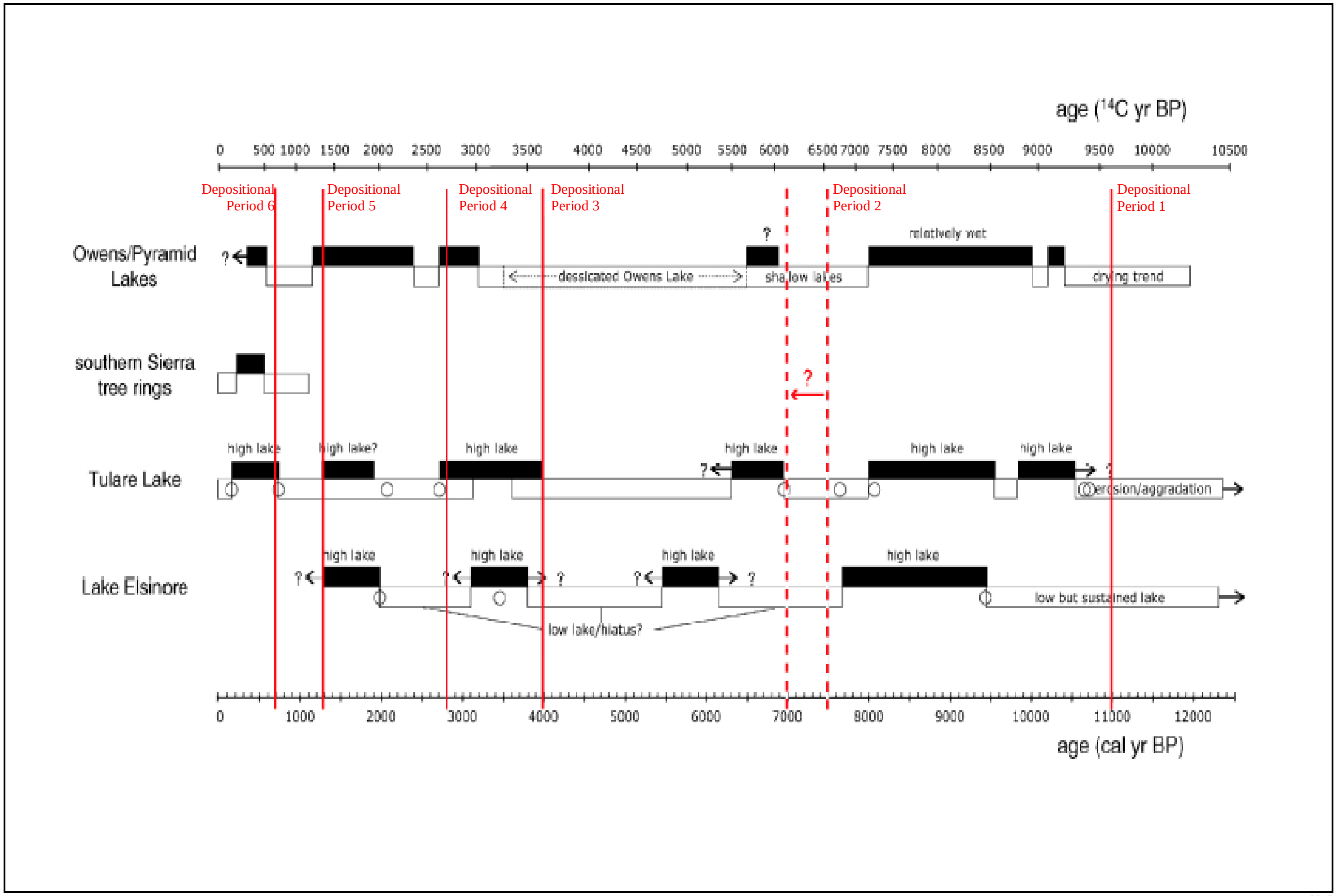

Figure 3-2

Holocene climate record. Representative Holocene climate records for Tulare Lake and other regions of the southwestern U.S. (from Negrini et al. 2006).

Red lines represent approximate periods of major widespread depositional events in central and northern California (Rosenthal and Meyer 2004; Rosenthal, White, and Sutton 2007). Note the very close relationship between the beginning and end of Tulare Lake highstands and the onset of deposition.

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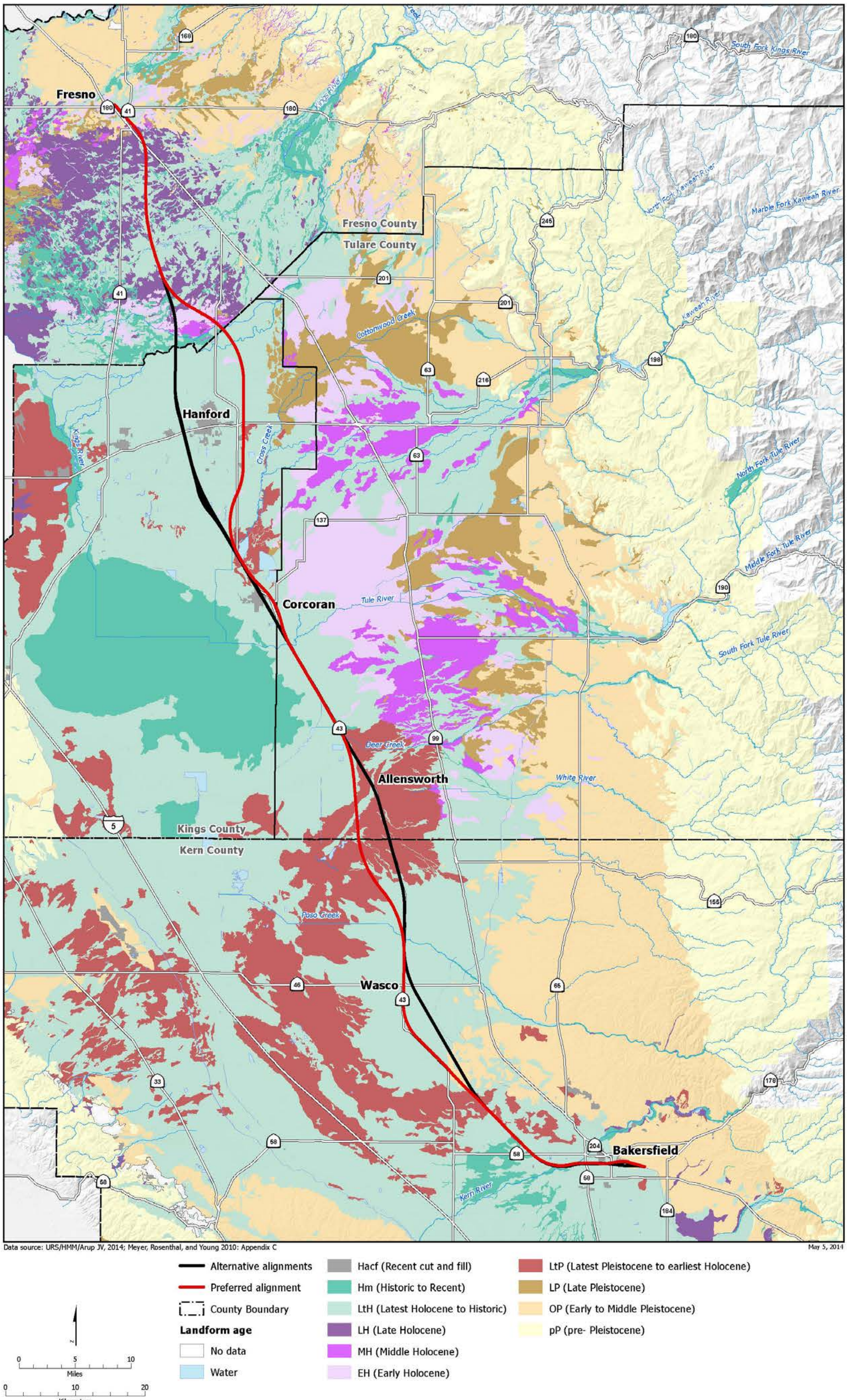

Figure 3-3
Landform age based on soil series

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3.2.5 APE Geoarchaeological Sensitivity

At the most basic level, buried site potential is dependent on the likelihood that a given landform contains buried soils (paleosols). These paleosols are representative of stable landforms that would have been conducive to human occupation. In general, the younger the surface soils are on a depositional landform, the more likely that landform is to contain buried stable surfaces of an appropriate age to potentially harbor buried archaeological sites. As such, the more recent (late Holocene and latest Holocene) portions of the alluvial fan and basin deposits shown on Figure 3-3 are the most sensitive for buried archaeological deposits.

However, as discussed above, archaeological sites are not distributed randomly on the landscape, but are chosen as a result of human need and cognition. These considerations include access to resources, proximity to trade routes, and desire to mitigate conflict with surrounding populations. Unfortunately, many of these considerations are difficult to quantify and are dependent on cultural norms that are elusive (at best), given the nature of the archaeological record.

Quantifiable environmental factors, such as proximity to water, precipitation, surface slope and aspect, and biotic zone, were tested against known archaeological sites to determine positive or negative correlations (Meyer et al. 2010:130). Meyer et al. used this regressive analysis to show that proximity to water was a significant factor in determining site location, with sites generally being farther from lakes and major rivers than from smaller springs and streams (Meyer et al. 2010:130–131). Additionally, it was determined that site slope played a less important, but correlative, role in determining site location (Meyer et al. 2010:130). These multiple environmental considerations were combined in a weighted relational database and used to create a geoarchaeological sensitivity map of Caltrans Districts 6 and 9 (Meyer et al. 2010:136). This sensitivity map is reproduced here with relation to the California HST archaeological APE (Figure 3-4; with larger-scale versions provided in Appendix A).

The Meyer et al. (2010) database and the relative acreages of a particular level of sensitivity were calculated in GIS to determine the amount of acres (or generally the amount of area) of a given sensitivity within each of the alignment alternatives' APE. The results are presented in Figure 3-5. The relative levels of sensitivity were ranked by Meyer et al. (2010) using a weights of evidence analysis with a scale of -3 to 6, whereby a score of less than 1 indicates a Very Low ranking; and 6 equals a Very High ranking. For example areas with surface slopes of 10 degrees or less, which are near water and associated with late Holocene surface deposits, were calculated by adding the slope and distance to water score of 2 to the latest Holocene score of 4, for an overall score of 6, or Very High. On the other hand, to calculate the score for areas with surface slopes greater than 10 degrees that are not near water and are associated with pre-Quaternary surface deposits, the slope and distance to water score of -2 was added to the pre-Quaternary score of -1 for an overall score of -3, or Very Low. As indicated in Figure 3-4, it appears that the Hanford West alternatives have a high or very high sensitivity for just over half of the area, whereas the Corcoran Bypass exhibits a very high rating for more than 90% of the area. In total, 39% of the APE, for all alternatives of the Fresno to Bakersfield Section, is modeled as having a very high or high sensitivity for buried archaeological resources.

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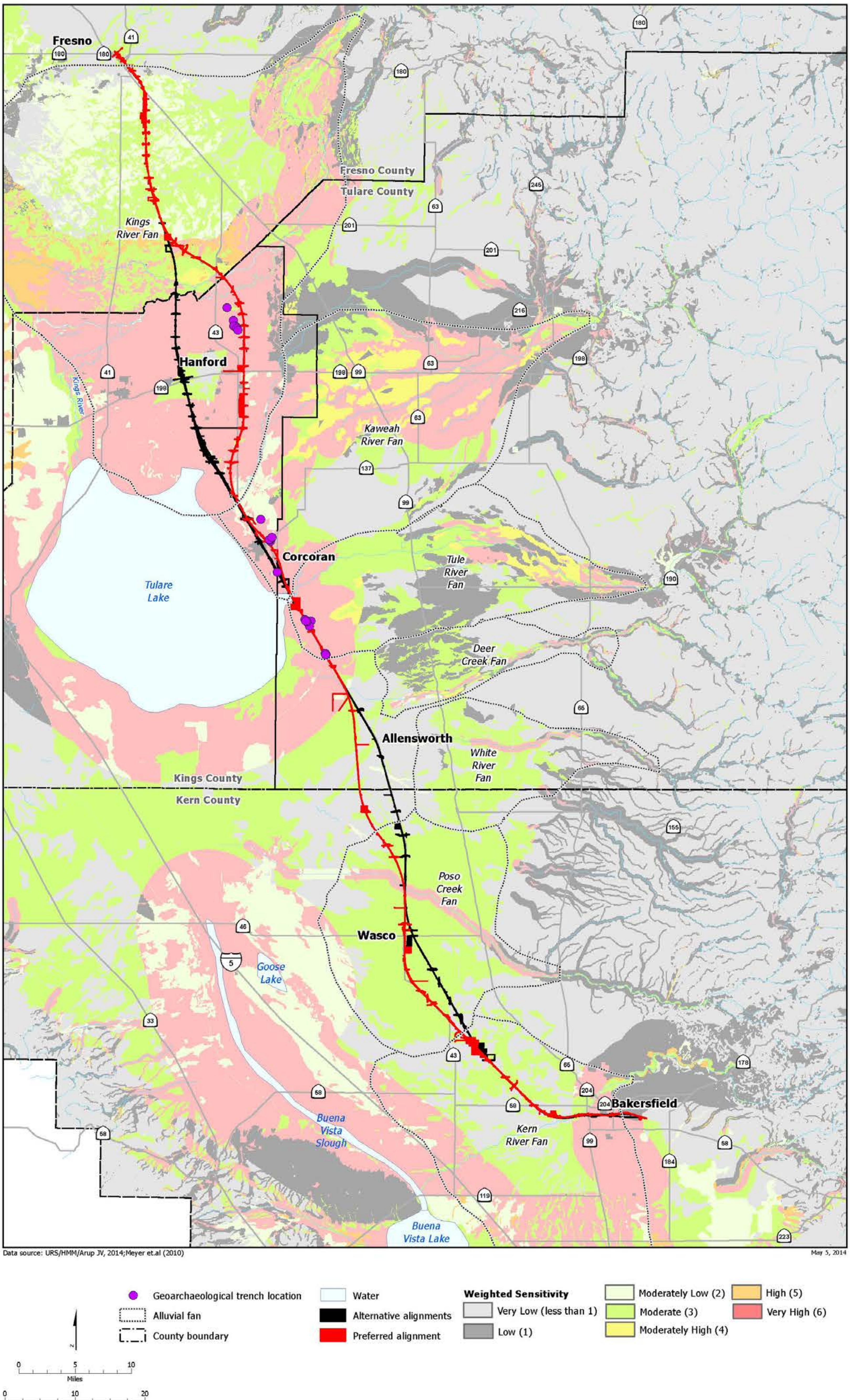

Figure 3-4
Weighted sensitivity for buried archaeology

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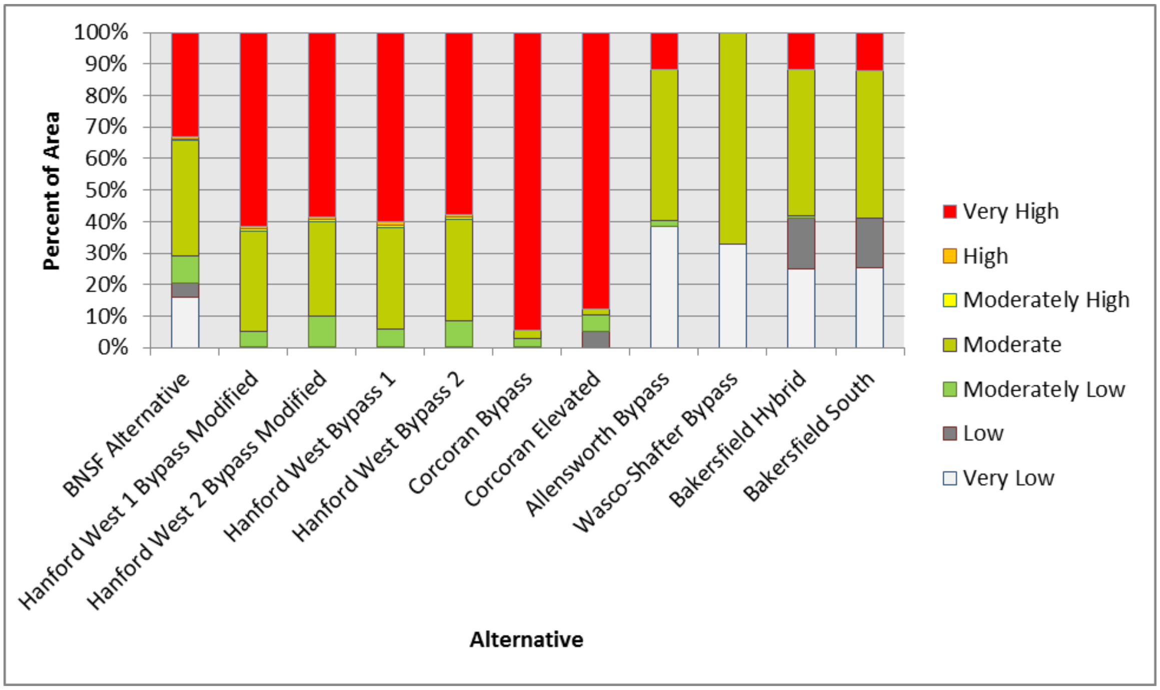

Figure 3-5
Geoarchaeological Sensitivity by Alternative Alignment (Percent Area)

As seen in the preceding discussion, and from the landform ages and the sensitivity model developed by Meyer et al. (2010), the sensitivity for buried archaeological deposits is variable across the California HST archaeological APE. Sensitivity ranges from very low to very high. The largest area of high sensitivity is between the Kings River (north) and Deer Creek/Alpaugh (south). The very high sensitivity of this area is primarily caused by the co-occurrence of the latest Holocene alluvial surface deposits (Figure 3-3) and proximity to the eastern shore of Tulare Lake (Figure 3-1); which, as discussed above, is known to have been a highly attractive resource to prehistoric populations. As discussed in the Findings section of the ASR (Authority and FRA 2011a:6-14) all of the prehistoric archaeological resources recorded during the field reconnaissance for this project are near the Tulare Lake paleo-shoreline.

Because of the sensitivity of large portions of the proposed California HST APE and the associated potential for affecting buried archaeological resources not identified during the field reconnaissance, a field geoarchaeological investigation was designed and implemented. As discussed in Chapter 4, this program consisted of targeted subsurface explorations (backhoe trenching), with a focus on those portions of the vertical APE with high geoarchaeological sensitivity, in order to confirm or refine the previously developed sensitivity model.

The background literature review presented here, the studies conducted by Meyer et al. (2010), and the resulting landform age and geoarchaeological sensitivity maps serve as a preliminary assessment of buried archaeological sensitivity for the region surrounding the California HST project. The field investigation discussed in the following chapter was designed to better understand the depth, location, and ages of specific paleosols within the California HST archaeological APE, and to test the veracity of the geoarchaeological sensitivity model within the APE. Secondarily, it was hoped that some of the excavations would improve our understanding of the timing and relationship of Tulare Lake shorelines to alluvial depositional events, and potentially identify specific buried archaeological sites within the APE.

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Chapter 4.0

Findings

4.0 Findings

4.1 Methodology

Due to the large geographic extent of the project, lack of well-defined subsurface impacts, and limited right-of-entry, the geoarchaeological field investigation was used to provide a sample of subsurface conditions across the APE, and to assess and refine the sensitivity model—rather than seeking to identify all buried archaeological deposits within the APE (which would necessarily require excavation of a prohibitively large portion, if not the entire, vertical APE). Subsurface geoarchaeological testing was performed by URS personnel in December, 2010 and March, 2011. A total of 21 exploratory trenches were excavated, at four distinct regions of the HST alignment alternatives. The trench locations were placed within the APE as defined at the time of investigation. Since that time, modifications to the project design have resulted in several of the trench locations dropping out of the APE; these locations are still useful in assessing the veracity of the sensitivity model and subsurface conditions of the landforms that the project is situated on.

Trench locations were initially established using an intersect of areas of very high sensitivity for buried archaeological sites (Figure 3-4) and parcels with permission to enter. Locations within these areas were then selected based on a desire to investigate a representative sample of the very highly sensitive landforms and soil types within the APE. The exact location and size of each trench was determined in the field based on existing conditions and constraints, and the ongoing results of trenching. Trenches averaged approximately 1.3 meter (4.3 feet) wide, 4.0 meters (13.1 feet) deep, and 6.5 meters (21.3 feet) long. The location of each trench was plotted in the field using a Trimble GeoexplorerXH global positioning system (GPS) device.

The presence or absence of archaeological materials was determined by examining and raking the sediment as it was removed from the trenches, and by examining the trench walls. The general nature of the exposed geologic deposits was recorded, with particular attention given to deposits that appeared to contain well-developed Holocene-age buried soils and/or archaeological materials. Project personnel were not allowed to enter a trench more than 1.5 meters (~5.0 feet) in depth, in accordance with the California Occupational Safety and Health Administration (Cal-OSHA) standards. If entry was required beyond this depth, in order to more closely examine exposed stratigraphy, hydraulic shoring was placed within the trench in accordance with Cal-OSHA standards by an excavation and trench competent person. All trenching was supervised by the project geoarchaeologist.

Stratigraphic units were identified based on physical characteristics such as composition, color, superposition, textural transitions, and pedogenic properties (i.e., relative soil development). Master soil horizons were defined using standard U.S. Department of Agriculture soil taxonomy (Soil Survey Staff 2006). This organizational system uses upper-case letters (A, B, C) to describe in-place weathering horizons. Most horizons and layers are given a single capital letter symbol, where:

> "A" is the organic-rich upper horizon developed at or near the original ground surface;
>
> "B" is the horizon formed in the middle of a profile, with concentrations of illuviated clays, iron, etc., and general changes in soil structure;
>
> and "C" is the relatively unweathered parent material which the other soil horizons formed upon.

These master horizons are preceded by Arabic numerals (2, 3, etc.) when the horizon is associated with a different stratum; where number 1 is understood but not shown, and lower

numbers indicate superposition over larger numbers. Lower-case letters are used to designate subordinate soil horizons (Table 4-1). Combinations of these numbers and letters indicate the important characteristics of each major stratum and soil horizon, from which inferences can be drawn. Various soil characteristics—such as blocky structure associated with silicate clay accumulation, or the accumulation of other minerals in the soil horizon—are indications of the amount of time that a landform was exposed at the surface prior to burial (i.e., its stability) and the environmental conditions that the landform was subject to prior to and after burial.

Table 4-1
Subordinate Distinctions within Master Soil Horizons

Subordinate Horizon	Description
b	Buried genetic horizon (i.e., buried and weathered in-place; not used with C-horizon)
c	Concretions or nodules (enriched with Fe, Al, Mg, etc.; not calcite)
k	Accumulations of alkaline earth carbonates, mostly calcium carbonate
ox	Oxidized iron and other minerals in parent material
p	Disturbed or artificial fill (including plow-zone)
t	Accumulation of subsurface silicate clay (illuviation)
w	Weak or poorly developed color/structure

Bulk samples of organic material from six of the identified buried soils were submitted for radiocarbon (14C) dating, in order to better quantify the timing of major geomorphic episodes within the APE. All dates are provided as calibrated radiocarbon years before present (cal B.P.); which is calculated as the central age intercept along the calibration curve, using the INTCAL09 database. The complete 14C data sheets, including 2-sigma probability ranges for each sample, are provided in Appendix B.

4.2 Results and Discussion

This section presents the results of trenching within the Project area, including the age, nature, and extent of the major subsurface strata identified, as well as the archaeological potential of each unit. Four geomorphic areas were investigated, and an attempt is made to correlate and interpret the sedimentary units between trenches within those areas. No archaeological materials were encountered during the exploratory trenching for this investigation.

4.2.1 Southern Kings River Alluvial Fan (North of Hanford)

Six trenches (T1 through T6) were excavated in an area approximately 3 to 4 miles northeast of Hanford. The area is situated on the southern terminus of the Kings River alluvial fan, between 1 and 3.5 miles south of the river's current course. On aerial photographs and soils mapping (Figure 4-1), numerous abandoned channel features are evident, indicating the dynamic nature of this portion of the Kings River fan, prior to agriculture-related channelization and irrigation. All of the trenches were excavated in areas with surface soils mapped as Kimberlina series soils, except for T1 on Nord complex soils, and T6, which was nearest to the Kings River on Corona series soils. Kimberlina and Nord series soils are believed to date to the latest Holocene, while Corona series soils are believed to date to the early Holocene (Meyer et al. 2010). Trenches are discussed in order, generally from north to south.

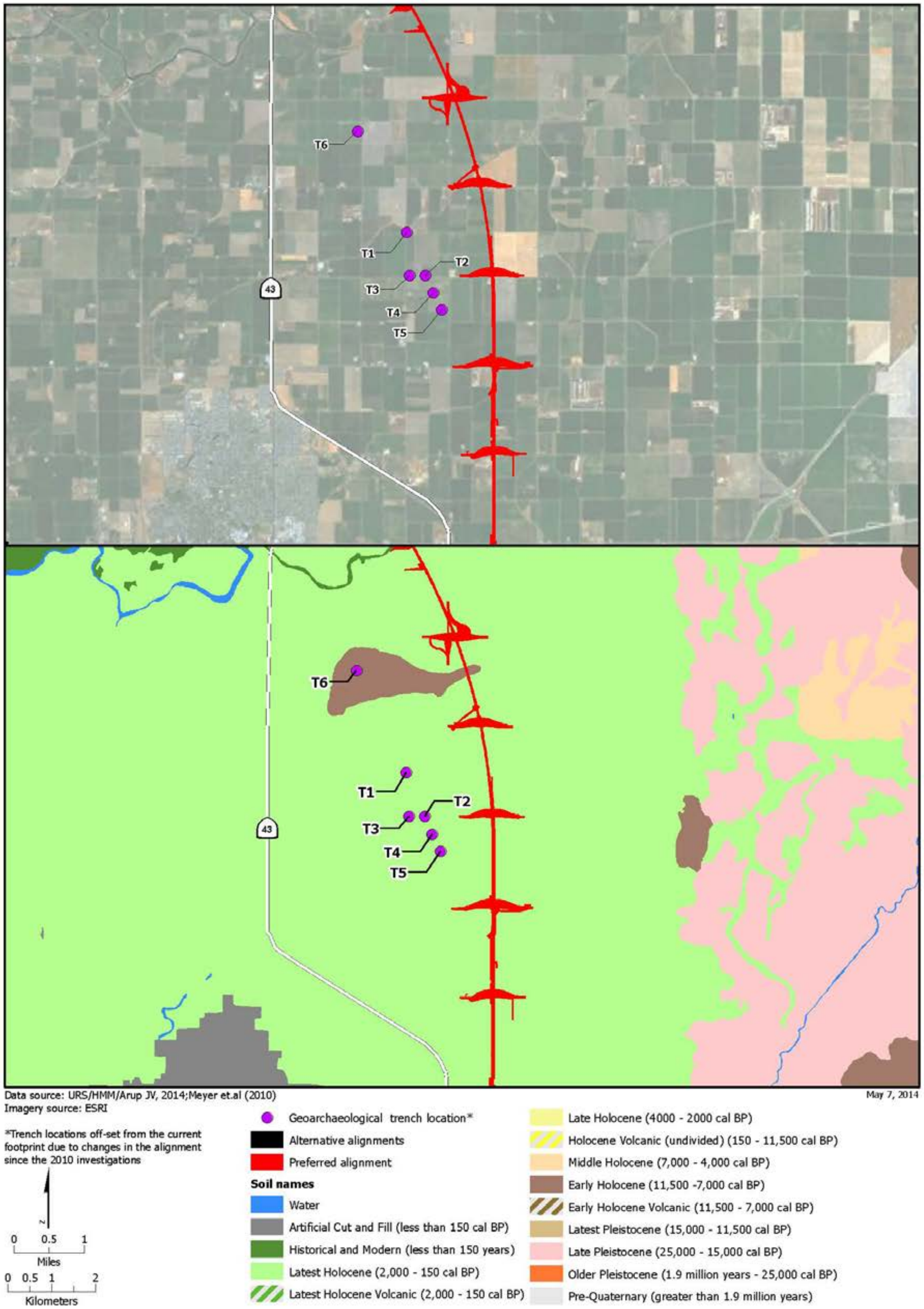


Figure 4-1
Soils mapping and aerial view for trenches T1 through T6

At the time of the investigations, all trenches were within the APE. Since that time, changes in the alignment have been made; this testing area is now approximately 0.5 to 1 kilometer (0.3 to 0.6) miles west of the current BNSF Alternative alignment. While the area is no longer within the proposed alignment, the results are valuable in understanding the general geoarchaeological sensitivity of the soil types and portions of the proposed alignments that traverse the Kings River alluvial fan.

T6

This trench was located the closest to the current course of the Kings River; however, the observed soil profile was very similar to the cumulic profiles seen in the other trenches in the area (Figure 4-2). The profile observed in T6 consisted of a very thick (~2.4 meter) fine grain (clay loam to silt loam) surface stratum, exhibiting a weakly to moderately developed soil profile (Ap/AB/Btkw/C) overlying a moderately developed buried alluvial surface. The contact with this buried surface was located at approximately 2.4 meters below the current ground surface. This buried landform has a moderately developed upper horizon (2Btbk) of silty clay with weak, angular blocky structure and few faint clay films on root pores and ped faces. This grades to a very fine, unweathered, loose, loamy sand parent material (2C). Given the very fine-grained (silty clay) nature of this buried landform, the level of observed soil development, and the approximate depth, the surface may correlate to the deeply buried surfaces observed in the other trenches in the area.

The surface soil (below the Ap horizon) at T6 was more well-developed than those observed in the other nearby trenches. This profile is generally consistent with the type description for Corona series soils (Soils Survey Staff 2012). Although no dates were acquired for the soils in T6, the similarity of subsurface horizons with other trenches excavated in the area suggests that the dating of Corona series soils to the early Holocene is incorrect (note the placement of T6 in a very limited area of “moderate” sensitivity, surrounded by “very high” sensitivity on Figure 3-4, Appendix A). Given the dates obtained for the buried surfaces, this location is either miscategorized as Corona series soils; or more likely, Corona series map units should be classified as middle Holocene at the earliest, and potentially much later.

T1

Of all of the trenches excavated north of Hanford on the Kings River alluvial fan, T1 exhibited the most distinctive deposition. The profile consisted of a thick cumulic series of at least five very poorly developed AC soil horizons (Figure 4-2). Cumulic profiles are indicative of a depositional environment where soil development roughly keeps pace with sediment deposition. Each of the very weakly developed A horizons is indicative of a brief period of landform stability, prior to continued deposition. The observed cumulic profile is consistent with the proximity of T1 to an abandoned arm of the Kings River, and the large amount of sediment transported (and deposited) by the river over time. The lowest stratigraphic unit observed in T1 (at 210 centimeters below surface) consists of an olive brown (2.5Y 4/3) ABb horizon underlain by at least two thick argilic horizons (5Btkb and 5Btb) with well-developed angular blocky structure. This well-developed lower unit is indicative of a much more stable landform than that observed in the upper portions of the trench.

Although the multiple A horizons (2AC; 3AC; 4AC) are indicative of multiple abbreviated depositional events, the lack of soil development indicates that the landforms were not exposed at the surface for an appreciable amount of time, and thus have reduced sensitivity for buried archaeological resources. Radiocarbon dating of the upper 10cm of the 5ABb horizon returned a date of 6575 cal B.P., indicating that this paleosol was buried during the middle Holocene, and was likely exposed at the surface for some time before that. Given the soil development in this lower unit, it may represent the Pleistocene Modesto formation ground surface, while the

overlying deposits are middle Holocene post-Modesto. The most sensitive location for buried archaeological resources would be the upper contact of the lowest depositional unit (i.e., between Modesto-age and post-Modesto deposits; ca. 210 centimeters below surface).

T2, T3, T4, and T5

Trenches 2, 3, 4, and 5 were all excavated within close proximity (ca. 0.25 mile radius; Figure 4-1) and exhibited the same weak upper cumulic soil profile (AC) observed in numerous other trenches in the area. However, unlike trenches 6 and 1, to the north, a distinct—though only weakly to moderately developed— buried soil was observed at approximately 1.2 meters below surface in all four trenches. This buried soil was identifiable by a significant increase in clay content and increased carbonate content (Btbk). However, given the extensive agricultural irrigation and soil amending that occurs in the area, it is unclear how much of this precipitated material may be the result of recent human modification.

Within T2, a second weakly to moderately developed buried soil (3Btwb) was observed at approximately 2.8 meters below surface. Given depth and qualities of the soil, it may be associated with the buried surfaces observed in T6 and T1 (2Btb and 5Ab horizon, respectively). A carbonate cemented hard pan was encountered at the bottom of Trench 2 at approximately 3.2 meters below surface. Given the degree of carbonate accumulation within this soil (stage III or IV; Birkeland, Machette, and Haller 1991:3), it likely represents a Pleistocene or older surface that is not sensitive for buried cultural resources.

The lowest buried surface in T4 (3Btkb) exhibited a similar degree of soil development as the other lower buried soils within T1, T2, and T6, but with a greater degree of carbonate accumulation (aside from the hardpan observed at the bottom of T2). Radiocarbon dating of the upper 10cm of this 3Btkb horizon returned a date of 6290 cal B.P., indicating that this paleosol was buried at approximately the same time as the paleosol dated in T1. The consistency of these dates, and the stratigraphic and pedogenic consistency of the lowest observed paleosols, indicates that there is an areally extensive buried landform along this portion of the lower Kings River alluvial fan.

These deepest stratigraphic units were absent in T3 and T5, suggesting that these profiles were deposited during the middle or late Holocene, in structural depressions (i.e., abandoned channel fill). In trench 5, this is confirmed by a larger sediment size (higher sand content) than any of the other trench profiles. This abandoned channel depositional setting is exhibited in Figure 4-3 (“flood channel deposits”), as well as the general depositional features seen in all of the trenches (e.g., the lowest extensive paleosol is represented by the “sequence bounding paleosol”).

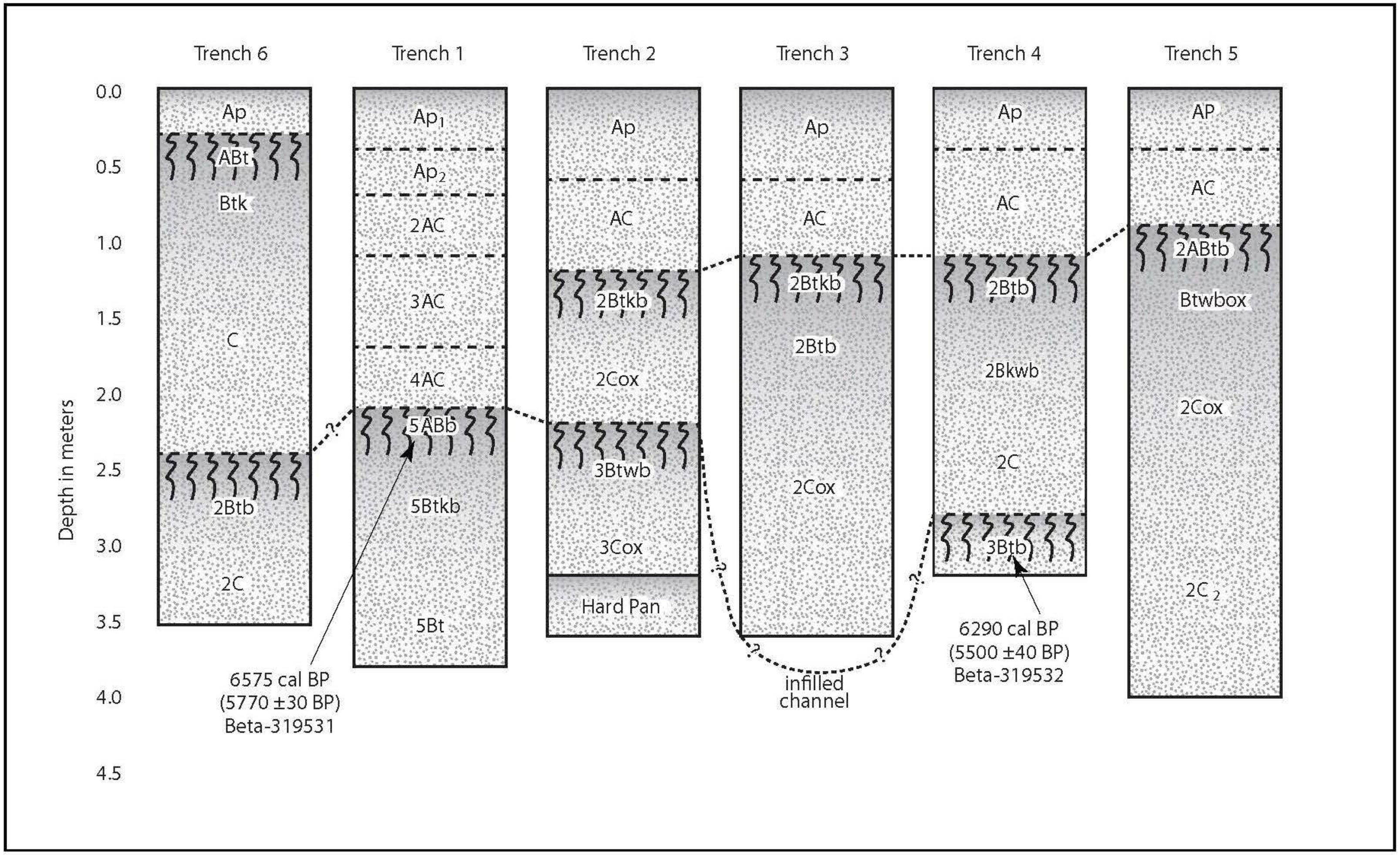


Figure 4-2
Soil profiles for trenches T1 through T6

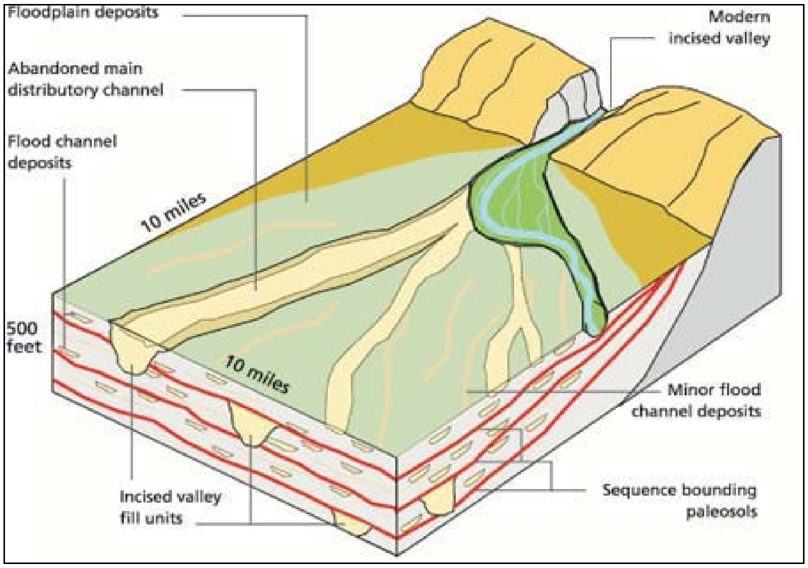


Figure 4-3
Idealized cross-section of an eastern San Joaquin Valley alluvial fan

Summary

In general, soil profiles examined within the southern Kings River alluvial fan are marked by cumulic profiles, with one or two poorly to moderately developed buried surfaces. There appears to be some spatial variability in where these buried surfaces are encountered. A surface identified in at least four of the trenches at greater than 2 meters below surface appears to represent an extensive stable landform, covered by cumulic alluvial sediments during the middle Holocene. Given the degree of soil formation, this paleo-landform was exposed at the surface longer than any of the other stratigraphic units observed, and is the most likely location for encountering buried archaeological deposits.

None of the upper buried soil units exhibited well-developed pedogenic characteristics, indicating that the post-middle Holocene depositional landforms accumulated gradually and consistently over an extended period of time. None of the paleosols observed in the upper profiles were exposed at the surface for an appreciable amount of time. This suggests that there is a limited potential for the accumulation of extensive multicomponent archaeological sites on these surfaces, as sedimentation would have likely outpaced such anthropogenic accumulation. A poorly developed paleosol was noted in T2, T3, T4, and T5, and covered by just over 1 meter of relatively unweathered (modern to latest Holocene) alluvium. All four of these trenches were excavated in areas mapped as Kimberlina series soils, and indicates that there is the potential for a shallowly buried paleosol (as well as the deeper, more well-developed paleosol) within this map unit. Any sites developed on these upper paleosols are likely to be more discrete or ephemeral sites, dating to the middle to late Holocene.

In general, these trenches confirmed the presumed latest Holocene age of Kimberlina series soils, and their associated potential for buried archaeological deposits. The age of the Corona series soils (T6), however, may need to be reassessed, because they appear younger than originally believed (Meyer et al. 2010: Appendix C) and, as such, may have a higher geoarchaeological sensitivity.

4.2.2 Southern Kings, Kaweah, and Tule River Alluvial Fans (Corcoran)

Six trenches (T13 through T18) were excavated in the vicinity of Corcoran (Figure 4-4). The area is situated on the coalescent alluvial fans of the Kings River, Kaweah River, and Tule River, near their interface with the Tulare Lake basin (Figure 3-4), and likely received sediment input from all four sources throughout the Quaternary. T18 was located approximately 3 miles north of Corcoran, T14 through T17 were located approximately 1 mile east of Corcoran adjacent to a canal that may partially occupy a paleo-channel of the Kaweah River, and T13 was located approximately 3 miles south of Corcoran closest to the paleo-shoreline of Tulare Lake. Even more so than the Kings River fan area discussed above, this area appears to represent a highly dynamic environment, with multiple active and abandoned watercourses observable on soils and historic maps (Figures 4-5 and 4-6). This dynamism is demonstrated by the wide variety of profiles observed in this group of trenches.

Except for T18 and T13 (the most northern and southern of the group) all of the trenches were excavated in areas mapped as Lakeside series soils, which are presumed to be latest Holocene in age (Meyer et al. 2010: Appendix C). T18 is mapped as Goldberg series (latest Pleistocene), and T13 is mapped as Grangeville series (latest Holocene). At the time of the investigations, all trenches were within the APE; since that time, changes in the alignment have been made. T13 through T16 are still within the APE, while T17 and T18 are now located 0.4 and 1.3 kilometers (0.25 mile and 0.8 mile) east of the current BNSF Alternative alignment, respectively. While these locations are no longer within the proposed alignment, the results are valuable in understanding the general geoarchaeological sensitivity and diverse soil profiles of the proposed alignments that traverse the terminal confluence of the Kings, Kaweah, and Tule River alluvial fans. Trenches are discussed in order, generally from north to south.

T18

Trench 18 was the only trench excavated in an area modeled as low sensitivity (Figure 3-4). This is primarily due to the location’s association with surface soils believed to be of latest Pleistocene age (Goldberg loam); implying that there has been no deposition from any of the adjacent alluvial fans or Tulare Lake since that time. Like all of the profiles observed in this investigation, the upper horizon consisted of a disturbed plow zone, followed by a silty loam depositional unit with a weakly to moderately developed B horizon; with blocky structure, and silicate clay and calcium carbonate accumulation (Btkw). This unit overlies another very similar moderately developed paleosol (2Btkb) at approximately 1.7 meters below surface; followed by a third equivalent paleosol (3Btkb) approximately 2.9 meters. Radiocarbon dating of the upper 10cm of the 2Btkb horizon returned a date of 10,190 cal B.P. Despite the lack of strong soil development in the overlying soil unit, this date suggests that the paleosol stopped accumulating organic material—and was covered by the overlying unit—during the terminal Pleistocene or early Holocene. As such, the assignment of latest Pleistocene age to Goldberg series soils appears to be roughly correct; although early Holocene may be more accurate.

Archaeological potential for the paleosols observed in T18, and the area as a whole, appears to be very low. The date obtained for the first paleosol (2Btkb) indicates that the surface landform may have been deposited around the time of the Pleistocene-Holocene transition (Depositional Period 1 on Figure 3-2), during or slightly after first human occupation in the region.

T17, T16, T15, and T14

Trenches 17, 16, 15, and 14 were excavated in close proximity to one another (within a 300-meter radius) but exhibited very different subsurface profiles (Figure 4-5). Each of these trenches was excavated adjacent to or within the boundaries of a prehistoric archaeological site (field

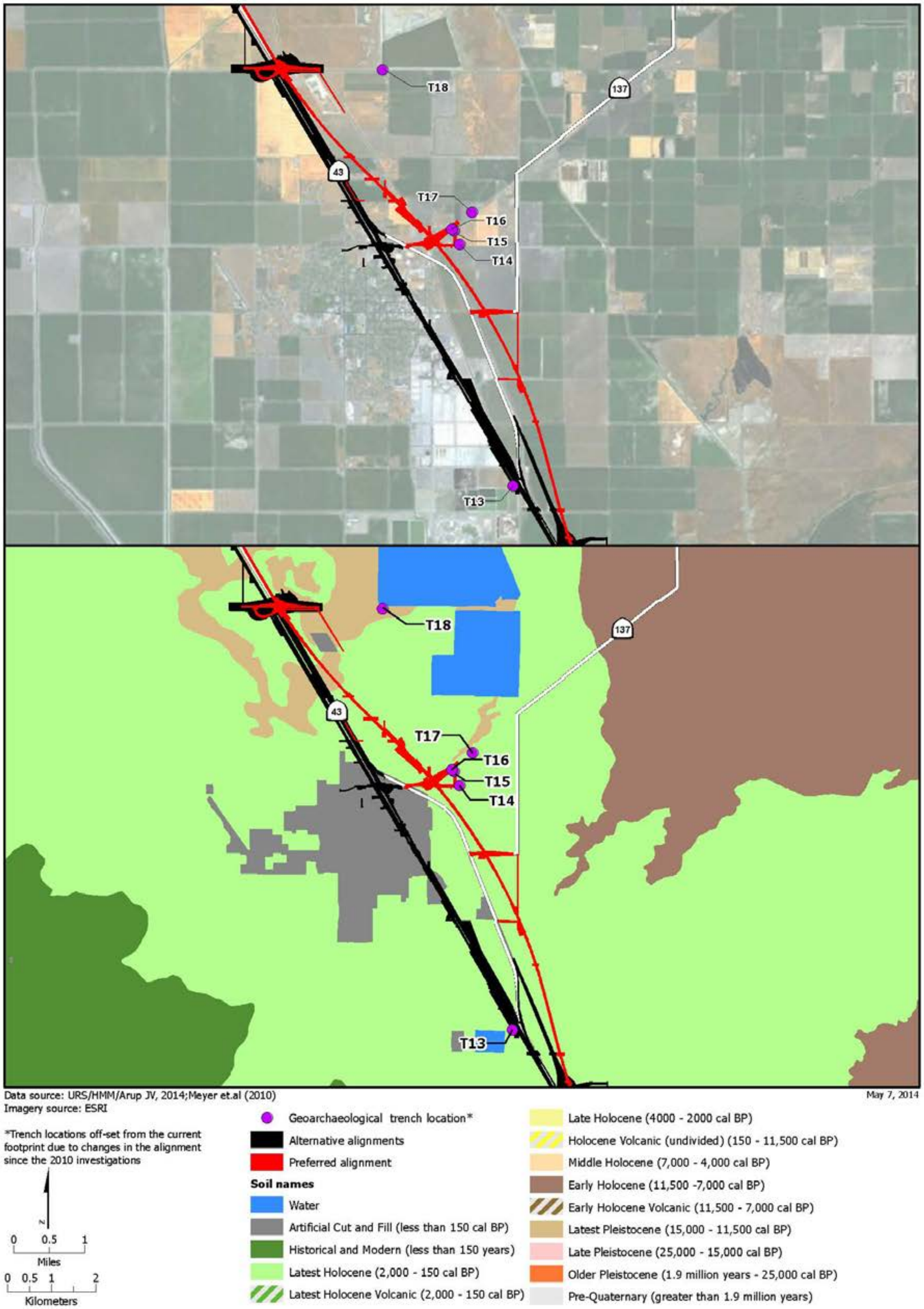


Figure 4-4
Soils mapping and aerial view for trenches T13 through T18

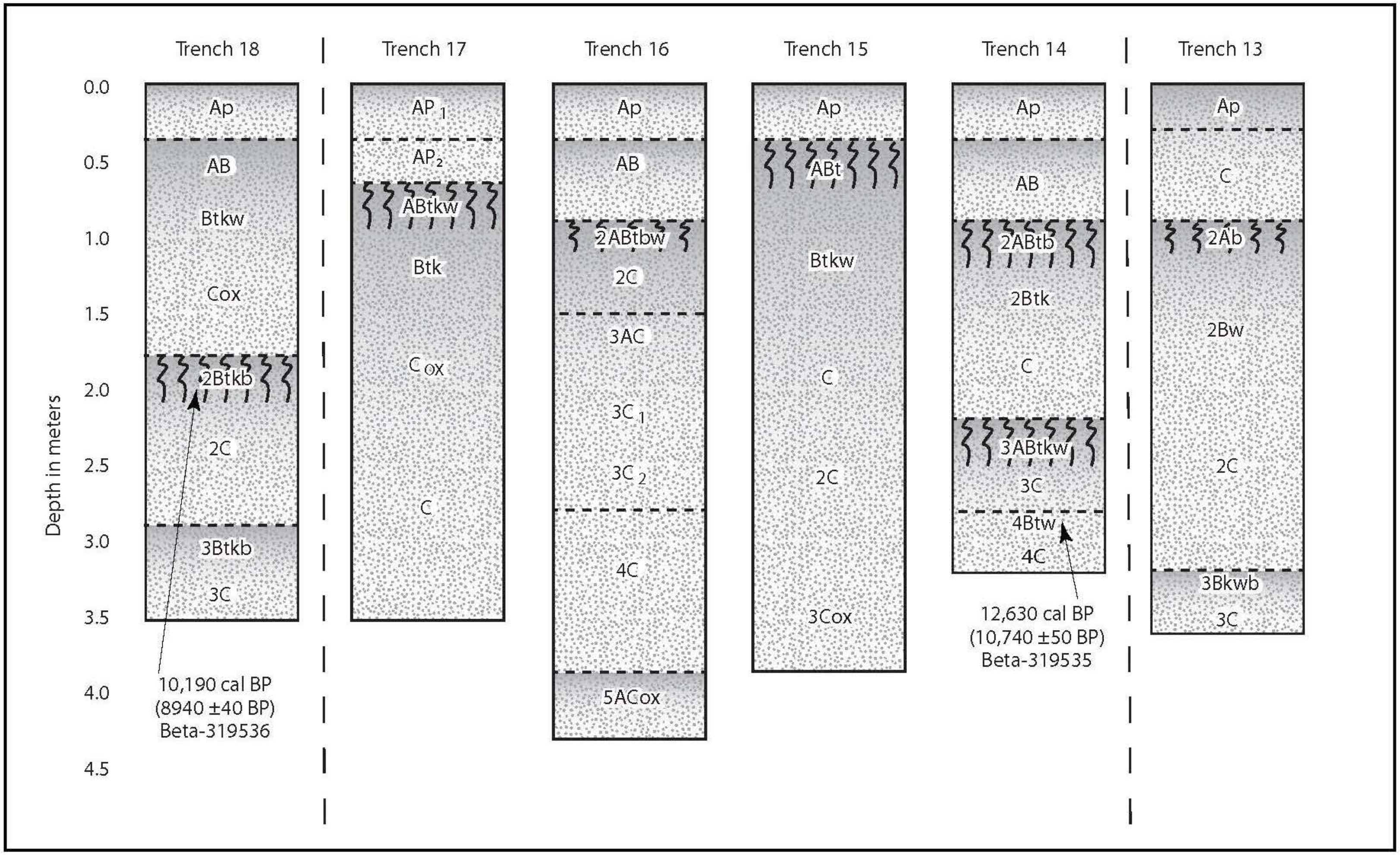


Figure 4-5
Soil profiles for trenches T13 through T18

recording number HST-KIN-1) which was identified by a very sparse surface scatter of chert and obsidian flakes and tools, faunal bone, and one plummet-style charmstone (Authority and FRA 2011a: Appendix E). No evidence of the site was seen in any of the trenches.

T17 was excavated on the north side of the Waukena Canal, where several possible minor paleo-channels of the Kaweah River are faintly observable on aerial photographs. The profile of T17 exhibited two distinct plow zones within the upper 60cm (likely the result of an early historic farming episode, followed by grading and imported fill). These disturbed plow zones were underlain by a thick cumulic package of silty loam to depth, with two pedogenic horizons with weak to moderate silicate clay and carbonate accumulation (ABtkw; Btk), and some oxidation of the parent material (Cox). The depth of the cumulic sediments suggests that they were likely deposited in a structural depression (i.e., an abandoned channel of the Kaweah River). Although no dates were obtained for these sediments, profile development indicates that they may have been in place before the latest Holocene. Nonetheless, the lack of observable paleosols or depositional hiatus implies a lack of sensitivity for buried archaeological resources. Excavated approximately 450 meters southwest, T15 exhibited a similar profile to T17, and may represent a downstream extension of the same abandoned channel. Active channel deposition within the profile is indicated by a loose, clean sand deposit (2C) at 2.4 to 2.8 meters below surface.

T16 exhibited a more complex subsurface profile than either T17 or T15, but also contained evidence of active channel deposition. A distinct, although weakly developed, paleosol with few very faint clay films on ped faces and interstitial pores (2ABtbw) was present at approximately 1 meter below surface. Below this paleosol were a sequence of relatively unweathered silty clay loam and clean sand lenses (3AC, etc.) deposited in or near the channel during alternating low and high water events. The deepest of these active channel units (4C) was an approximately 1-meter-thick deposit of well-sorted loose sand, burying a very weakly developed oxidized silty clay loam paleosol. Aside from the upper paleosol at approximately 1 meter below surface, none of the buried surfaces within T16 appear to have been stable for an appreciable time, or conducive to human occupation.

The subsurface profile of T14 bore some similarities to T16. The same upper paleosol (2ABtb) was present at approximately 1 meter below surface. However, rather than being developed on top of a series of sandy channel deposits, this silty clay loam soil unit buried a second terrestrial paleosol (3ABtkw) with weak pedogenic clay and calcium carbonate mottling. Radiocarbon dating of the upper 10cm of the 3ABtkw horizon returned a date of 12,630 cal B.P. This date suggests that the paleosol stopped accumulating organic material, and was covered by the overlying unit, during the latest Pleistocene. This land surface was likely buried too early to be very sensitive for archaeological deposits; and given approximate stratigraphic and temporal consistency, may be correlative with the paleosol (2Btkb) dated in T18.

T13

T13 was located the furthest southwest, closest to Tulare Lake, of all of the trenches in the vicinity of Corcoran; however, no distinct lake sediments were observed in the profile. Unlike the other trenches, which were excavated within or near agricultural fields, T13 was excavated in a storm water settling pond owned by the city. The ground surface here was several feet lower than surrounding areas and it is possible that organic-rich upper lake sediments were removed during construction of the basin. The lack of distinct lake deposits lower in the profile supports the hypothesis that Tulare Lake did not reach its maximum elevation or extent until the latest Holocene or historic-era (Meyer et al. 2010:30).

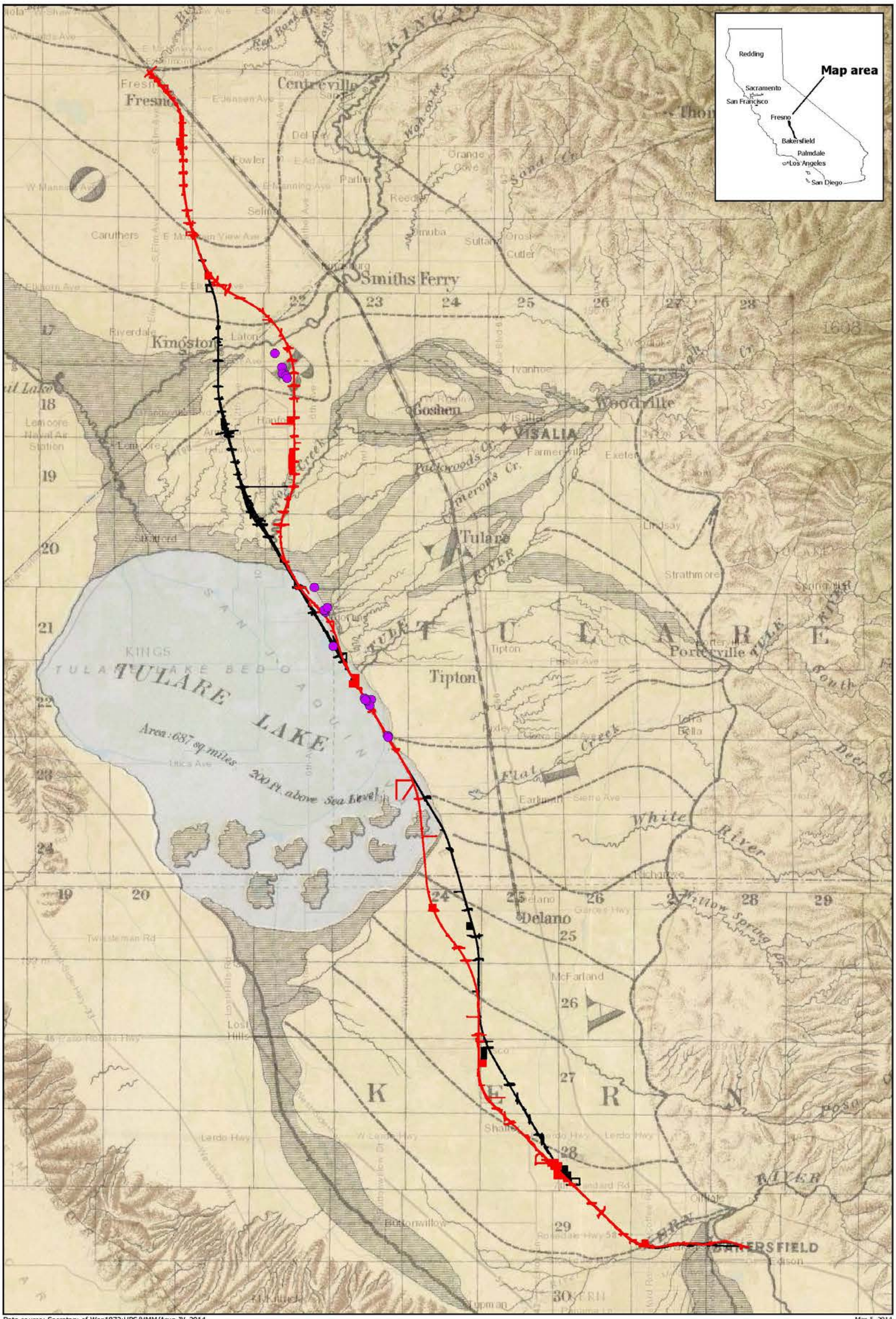
As with other profiles in the area, T13 consisted of a thick cumulic depositional package with stratigraphic variability in sand, silt, and clay content, but very few indicators of pedogenesis (e.g., organic accumulation, structural development, silicate clay, and mineral accumulation,

etc.). Although some of the textural transitions were defined as weak pedogenic horizons (2Bw; 3Bw), they are more probably indicative of cyclical changes in depositional environment, with higher silt and clay contents derived from low-energy deposition (alluvial floodplain, near-lake seasonal wetlands, etc.) and higher sand contents from higher energy episodes. Lack of defined paleosols or stable buried land surfaces within T13 indicates a generally low sensitivity for buried archaeological resources. The only possible exception to this is the uppermost buried surface (2A) at approximately 1 meter in depth, which may be correlative with the upper paleosols observed in T16 and T14, or may be the result of historical burial of a mechanically excavated surface within the settling basin. The latter appears more likely, given the lack of observed pedogenesis at this contact.

Summary

Like other areas investigated for this study, soil profiles near the interface of the Kings, Kaweah, and Tule river fans are marked by thick cumulic profiles, with one or two distinct poorly to moderately developed buried surfaces. There appears to be considerable spatial variability in where these buried surfaces are encountered; consistent with historic mapping of the area, which shows a series of delta-like channels issuing from the various river systems into Tulare Lake (Figure 4-6). A buried surface identified in at least three of the trenches (T14, T16, and T17), at approximately 1 meter below surface, appears to be the most sensitive location for buried archaeological resources within the Corcoran area. However, given the proximity of the three trenches (within a 300-meter radius) the extensiveness of this paleosol is unknown. All three of these trenches were excavated in areas mapped as Lakeside series soils, which are believed to date to the latest Holocene, and which bury the observed paleosol. In T14, this paleosol buries a second paleosol at approximately 2.2 meters (3Btkw), which was dated to the terminal Pleistocene (ca. 12,000 B.P.). As such, the upper paleosol may have been originally deposited at any time during the Holocene, and should be considered sensitive for buried archaeological resources.

Based on dating, depth, and soil properties, the lower paleosol in T14 may correlate with the upper paleosol observed to the north in T18. Given the age at which this surface was buried, it is not considered very sensitive for buried archaeology. The age and lack of buried surfaces within T18 is consistent with the latest Pleistocene and low weight assigned to the Goldberg series soils in the sensitivity model. The presence of a shallowly buried Holocene age paleosol within three of the five trenches (T14, T16, and T17), excavated within the areas of very high sensitivity, confirms that these areas have general sensitivity for buried archaeological resources; further supporting the sensitivity model. This sensitivity is heightened due to the rich environmental setting within a presumed seasonal deltaic wetland, near to Tulare Lake. However, this same setting also makes for irregular preservation of paleosols and associated buried archaeological resources, due to the erosion and subsequent deposition within a constantly changing pattern of major and minor hydrologic channels. Identification of buried archaeological resources will be difficult in this setting, without extensive excavation.



- Georarchaeological trench location

Archaeological APE

- Alternative alignments
- Preferred alignment

0 5 10 Miles

0 10 20 Kilometers

Figure 4-6
1874 Map of Tulare Lake and environs

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4.2.3 Distal Tule River Alluvial Fan and Tulare Lake Shoreline (Angiola)

Six trenches (T7 through T12) were excavated just north of Angiola. The area is situated at the toe of the Tule River alluvial fan, near its interface with the Tulare Lake basin (Figure 3-4). All of the trenches were excavated in areas mapped as Armona series soils (Figure 4-7), which are presumed to be latest Holocene in age (Meyer et al. 2010: Appendix C). Trenches 11 and 12 were excavated at the boundaries of a prehistoric archaeological site (field recording number HST-TUL-1), which was identified by a very sparse surface scatter of chert and obsidian flakes (Authority and FRA 2011a: 6-17). No evidence of the site was seen in any of the trenches. Trenches are discussed in order, generally from north to south. All trenches were located within or right next to the BNSF Alternative alignment.

T9, T7, T11, and T12

Trenches 9, 7, 11, and 12, all excavated within close proximity (ca. 200 meter radius), exhibited the same upper profiles (Figure 4-8), consisting of two distinct plow-zones (Ap; Ap_2) over a very weakly developed pedogenic horizon with weak subangular blocky structure (Btkw). At approximately 1 meter below surface, this upper soil unit buries another weakly developed olive gray (5Y 5/2) sandy clay loam paleosol, with gray carbonate mottling, and weak to moderate subangular to angular blocky structure (2Btbk). Radiocarbon dating of the upper 10cm of the 2Btbk horizon in T12 returned a date of 6,830 cal B.P. Despite the lack of strong soil development in the overlying soil unit, this date suggests that the paleosol stopped accumulating organic material, and was covered by the overlying unit, during the middle Holocene; which roughly corresponds with the second major depositional period shown on Figure 3-2. Given this information, the assignment of latest Holocene age to Armona series soils appears to be incorrect. These surface soils more likely formed during the middle or late Holocene. None the less, given the presence of a middle Holocene paleosol at approximately 1 meter below surface, the series does appear sensitive for buried archaeological deposits.

Below the surface of this paleosol, each trench exhibited slightly different stratigraphy. T9 consisted of a series of unweathered horizons (2Cox; 2C; 3C) grading from indurated silty sand to loose sand with silt, which likely represents active channel deposits. T7 exhibited a similar series of indurated and loose sands, with the exception of an approximately 1-meter-thick deposit of silty clay (3ACox) at approximately 3 meters below surface. This dark sediment with high mica and silicate content likely represents a lacustrine deposit. T12 exhibited similarities to both T9 and T7, with indurated silty sand grading to loose channel sands, overlying similar clay-rich lake sediments at 3.5 meters below surface (3ACox). T11, like T9, lacked any lacustrine clay deposits and had a single fining-upward sequence of bedded loose river sand deposits, indicating that the entire +3-meter package may have been deposited as part of a braided stream system of the paleo-Tule River.

T8

T8 was excavated approximately 500 meters east of the main group of trenches discussed above (Figure 4-7). Pedostratigraphic units were very similar to those observed in T7 (Figure 4-8), but with the upper soil unit slightly thicker and better developed with higher clay content, and the upper paleosol (2Btkb) occurring slightly lower (ca. 0.35 meter). The same dark clay-rich possible lacustrine sediments (3ACox) were also present at the base of T8. However, the lack of observed freshwater shell in any of the mica-rich clay deposits in all of the trenches raises questions about a relationship to a paleo-Tulare Lake.

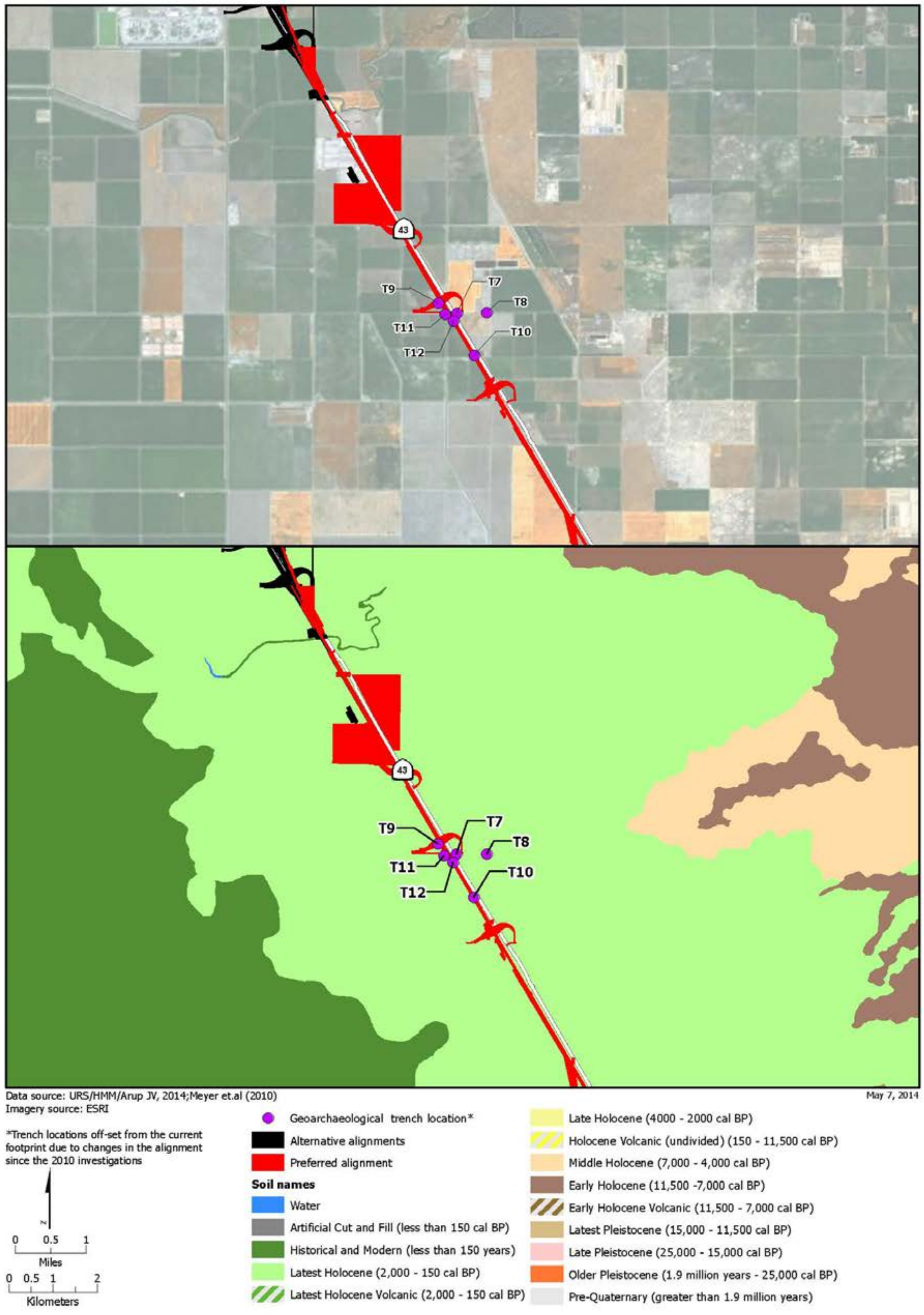

Figure 4-7
Soils mapping and aerial view for trenches T7 through T12

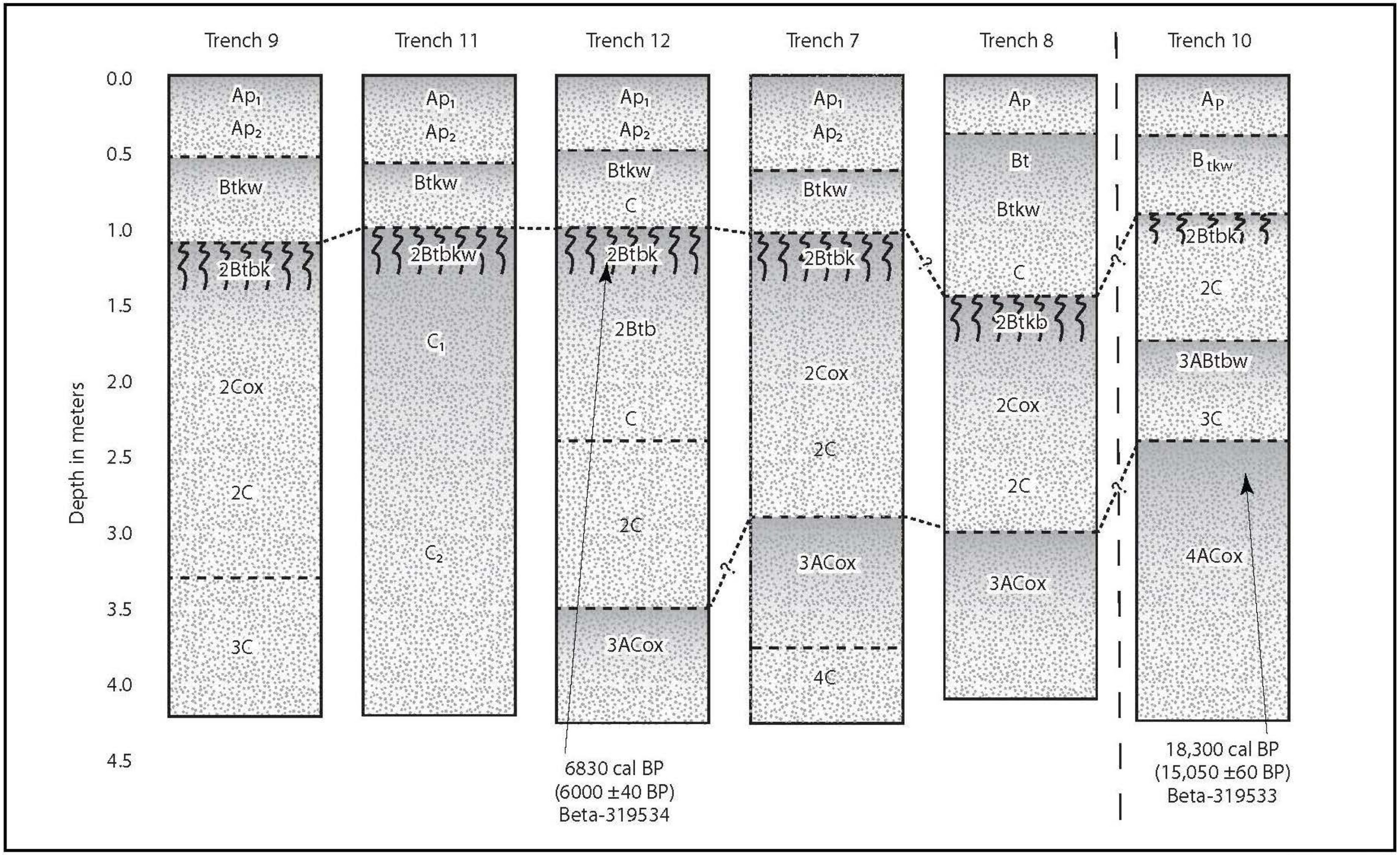

Figure 4-8
Soil profiles for trenches T7 through T12

T10

T10 was excavated approximately 800 meters south of the main group of trenches (Figure 4-7). Observed stratigraphy was very similar to that of other trenches in the area, with the first weak, angular, blocky silty clay loam paleosol (2Btkb) encountered at approximately 1 meter below surface (Figure 4-8). This was followed by a second weakly developed soil (3ABtbw) not observed in the other trenches. This olive-brown (2.5Y 4/3) weak, subangular, blocky silty clay was developed on a clean, loose granitic river sand (3C), which as a whole is a single fining-upward sequence, indicative of a single channel meander event. This second unique paleosol overlies an over 2-meter-thick coarsening-upward package, from clay at the base of the trench to a very weakly developed silty clay loam (4AC) at the upper contact. This lowest coarsening-upward sequence may represent a lake recession, with the deep-water clays giving way to near-shore silts and sands. Radiocarbon dating of the upper 10cm of the 4AC horizon in T10 returned a date of 18,300 cal B.P. This date places the lowest stratigraphic unit well into the Pleistocene, and indicates that the overlying weakly developed soil (3ABtbw) began to be deposited during the late Pleistocene. As such, neither of these lower stratigraphic units is considered very sensitive for buried archaeological deposits.

Summary

Several paleosols and depositional sequence boundaries were observed within the trenches north of Angiola. However, dating of two of these buried surfaces indicates that they were buried much earlier than anticipated. The deepest soil dated, at 2.5 meters below surface in T10, was buried prior to the earliest evidence for human occupation of the Americas. The distinct areally extensive paleosol, at just over 1 meter below surface in all of the trenches, dates to the middle Holocene. This buried surface is considered sensitive for archaeological resources, though the date raises questions about the assignment of latest Holocene age to Armona series soils; and thus the assignment of very high sensitivity to the map unit (Figure 3-4).

Current research by Meyer et al. (2010:77) indicates that the Tulare Lake did not reach its maximal extent until the latest Holocene (ca. 200 BP). This was due to accretion of the lower Kings River Fan, which blocked outflow of the lake to the north. It appears that the shoreline was located at 62 meters elevation for much of the late Pleistocene and early-to-middle Holocene, and again during the late Holocene. As such, the trench locations (and the APE) would have been within 1 kilometer of the shoreline for much of prehistory, thus increasing the sensitivity of the buried middle Holocene landform.

4.2.4 Distal Tule River and Deer Creek Alluvial Fans and Tulare Lake Shoreline (South of Angiola)

The final three trenches (T20, T21, and T22) were excavated 2 miles southeast of Angiola, within the BNSF Alternative alignment. As with the previous trenches, the area is situated at the toe of the Tule River alluvial fan, near its interface with the Tulare Lake basin, and may also have some prehistoric alluvial input from the minor fan of Deer Creek to the south. All of the trenches were excavated in areas mapped as Excelsior series soils (Figure 4-9), near a contact with Houser series soils, both of which are presumed to be latest Holocene in age (Meyer et al. 2010: Appendix C). All trenches were excavated adjacent to the boundaries of a prehistoric archaeological site (field recording number HST-TUL-3), which was identified by a sparse surface scatter of late-stage chert and obsidian flakes, a few biface fragments, and two beads, all identified within a dirt agricultural road (Authority and FRA 2011a: 6-18). No evidence of the site was seen in any of the trenches. Trenches are discussed in order, generally from north to south.

T20, T21, T22

All three trenches were excavated within close proximity (approximately 125-meter radius) and exhibited some generally similar stratigraphic characteristics (Figure 4-10). All trenches contained a moderately developed soil at approximately 70cm below surface, below one or two disturbed plow zones (Ap; 2Ap). The most distinct soil development at this surface was observed in T22. Here, the soil consisted of indurated clay that readily forms medium size angular blocky peds with common distinct clay films and carbonate coatings on ped faces and pores (Btk_1). This is followed by a second less well-developed pedogenic clay loam horizon ($Btkw_2$) overlying a thick cumulic alluvial package with minor textural variations. Within T21, tar paper and tar were present at this buried surface, discoloring the soil and indicating that the soil was exposed at the surface during the historic-era. Similar discoloration, presumably from the same source, was seen in T20. In both T20 and T21, the secondary weak structural horizon (2Btkw) was also present, followed by unweathered silty clay loam grading to moist loose clean sand at depth. Cross-bedding within the deeper sand deposits suggests deposition in an active meandering or braided channel system.

Summary

The soil development observed below the disturbed plow zone (Ap) in all three trenches is not consistent with an assignment of Excelsior series soils, whose typical profile includes a series of unweathered C horizons with minor textural transitions and no soil development at the surface (Soil Survey Staff 2012). Although no dates were acquired for this surface, the presence of historic debris suggests that it was exposed at the surface during the last century, and was only buried with imported fill (likely related to the widespread grading throughout the valley) in historic times. It is also possible that the original ground surface was excavated and redeposited, as there is no well-developed organic-rich A horizon present. In part, the high clay content of this surface may indicate deposition from the historic high-water zone of Tulare Lake.

Soil development at this shallowly buried surface indicates that it was exposed for a considerable amount of time, especially relative to the other paleosols observed throughout the project area. It appears that the Excelsior series has been misapplied to this locale, and that the soils are likely more similar to the latest Pleistocene surface soils found to the southeast (e.g., Gareck-Garces association soils) (Meyer et al. 2010: Appendix C). As such, this location is interpreted to have a low sensitivity for deeply buried archaeological resources. Although it is possible that archaeological materials are associated with the upper Btk horizon, the significant historical disturbance would suggest that sites at this depth were either removed, or would be incorporated into the upper disturbed plow zone, and thus evident at the surface. Overall, this location is interpreted as having a moderate potential for buried archaeological resources, more similar to those areas of older soils within the APE immediately to the southeast.

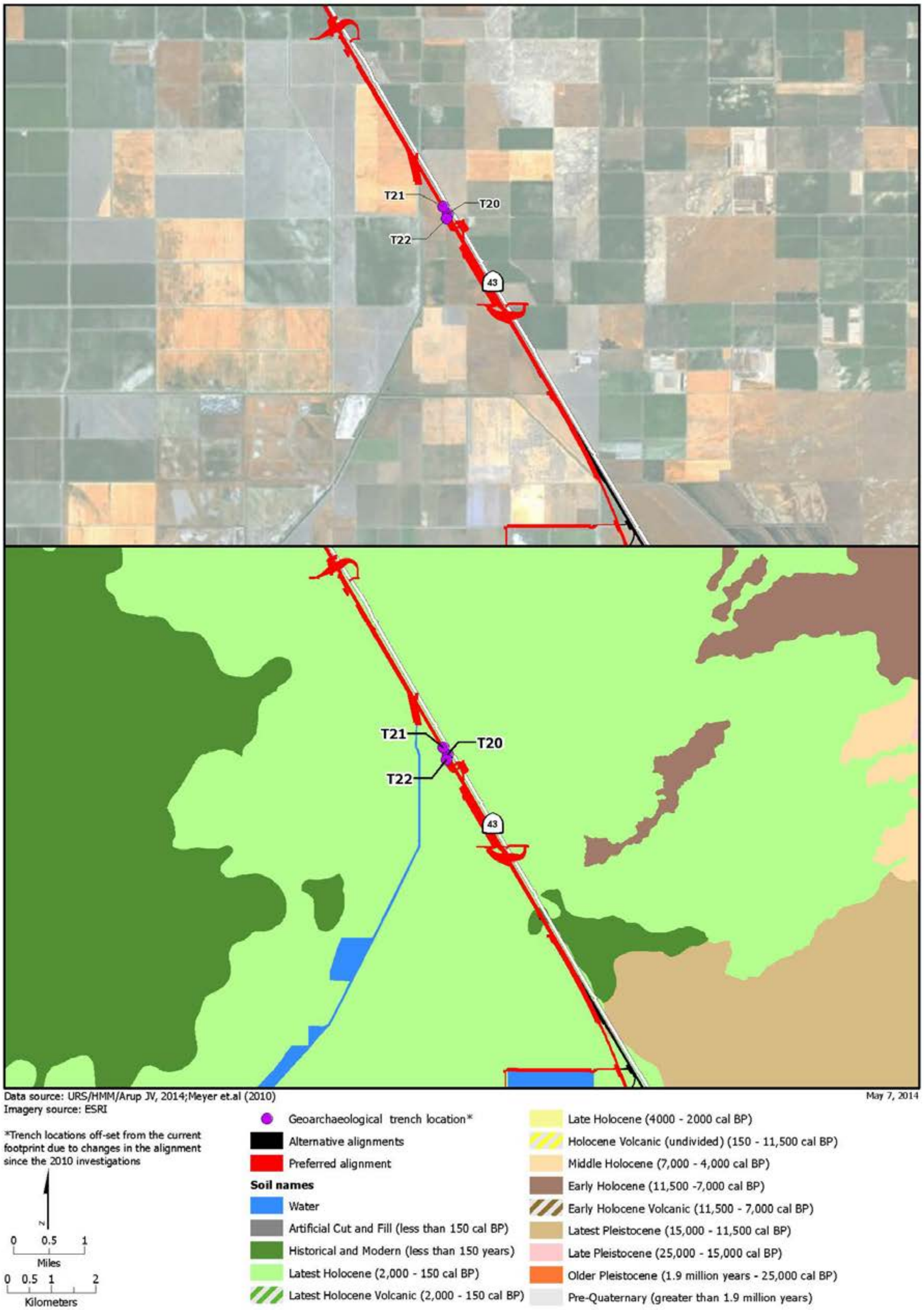

Figure 4-9
Soils mapping and aerial view for trenches T20 through T22

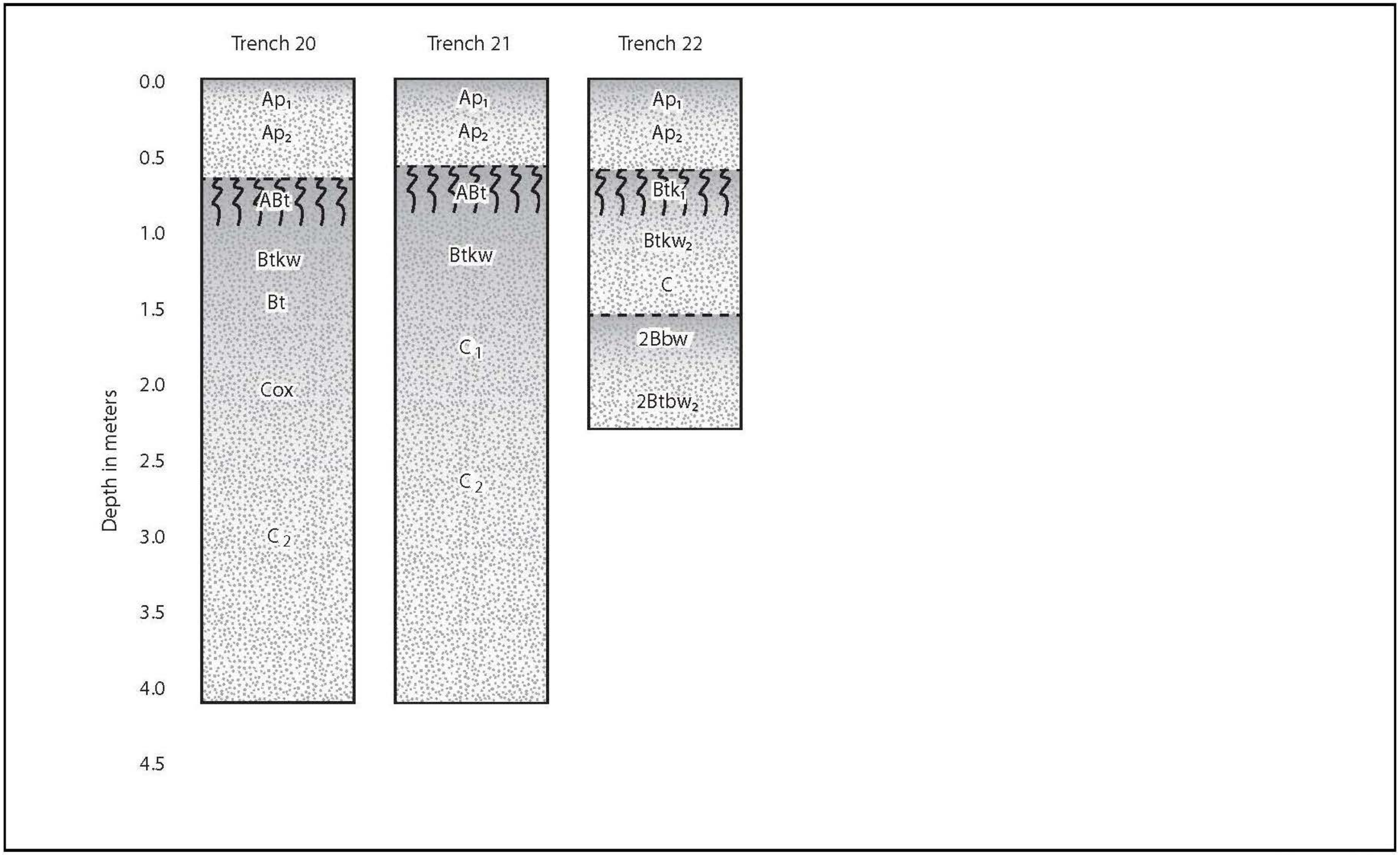

Figure 4-10
Soil profiles for trenches T20 through T22

4.3 Conclusions and Recommendations

In the original geoarchaeological sensitivity study of the southern San Joaquin Valley, Meyer et al. (2010:147) conclude that, "since the [sensitivity] model's overall utility can only be evaluated if it is systematically tested, most subsurface survey effort should be directed to Very High potential zones. If no buried sites are encountered in these areas after a reasonable amount of investigation (i.e., several large projects), then the model should be reevaluated." Given the scale of the HST Fresno-Bakersfield archaeological APE, and the limited scope of this initial geoarchaeological field investigation, it is perhaps not surprising that no buried archaeological deposits have yet been encountered. At the same time, the scope of the project also makes it cost prohibitive to conduct a thorough subsurface investigation of all very high sensitivity portions of the APE, to completely rule out the possibility of disturbing potential buried historic properties. A diverse approach is required to adequately identify and mitigate disturbance to buried archaeological resources.

Although impacts to buried archaeological sites is always a potential concern, particularly for projects with extensive horizontal and vertical footprints, the importance of buried archaeological sites within the Fresno to Bakersfield HST project area is heightened by the lack of intact surface sites. As discussed in the ASR (Authority and FRA 2011a:6-19) the 20th century history of intensive grading, plowing, and hydrologic modification of the project area resulted in the destruction of countless surface archaeological sites prior to the advent of systematic archaeological surveys. This is demonstrated in the few prehistoric sites examined during Extended Phase I investigations (Authority and FRA 2011a: Appendix F), which were consistently demonstrated to be sparse surface manifestations in dirt roads and agricultural fields, likely heavily disturbed and redeposited from their original contexts. As a result, only a handful of intact archaeological sites have been systematically studied in the region, resulting in a sporadic understanding of local prehistory.

Given the large areas of Holocene sedimentation and highly dynamic alluvial environment demonstrated in this initial geoarchaeological investigation of the Fresno to Bakersfield HST project area, it is difficult to anticipate precisely where buried archaeological resources will be located. The excavations broadly support the sensitivity model developed by Meyer et al. (2010); aside from the most southern area investigated (T20, T21, and T22), which demonstrated a much lower sensitivity than predicted by the model. In the other areas investigated, there appears to be strong variability in the preservation potential within highly sensitive areas, due to the presence of numerous abandoned channels (both major and minor) associated with the various drainages. This same variability is represented in the numerous paleosols observed and dated for this project.

Within the vicinity of the Kings River fan, northeast of Hanford, a semi-ubiquitous middle Holocene paleosol was identified between 2 and 2.5 meters below surface. A much younger paleosol was also observed at approximately 1 meter below surface. Although none of these paleosols were identified across each of the six trenches excavated, there was enough consistency to support the sensitivity model within this area. Furthermore, the results suggest that the areas modeled as highest sensitivity within the southern Kings River alluvial fan have the potential for buried archaeological resources down to at least 3 meters below surface.

Within the vicinity of Corcoran, near the intersection of the Kings River and Kaweah River alluvial fans, T18 was excavated in surface soils predicted to be of late Pleistocene age and low sensitivity. This was confirmed through soil profile examination and dating. Within the remaining trenches, one or two paleosols were present, generally at approximately 1 meter below surface and a second deeper than 2.2 meters. This deeper paleosol was dated within T14 to over 12,000 B.P., indicating a low sensitivity at this depth. As such, the highest probability for encountering buried archaeological resources within the very high sensitivity landforms in the Corcoran vicinity

appears to be at approximately 1 meter below surface. However, this sensitivity is locally highly variable due to the presence of numerous meandering active and abandoned channels, related to the historic geomorphic slough-like setting at the edge of Tulare Lake. These numerous channels appear to have variably scoured the landscape, eroding or preventing the formation of areally extensive stable landsurfaces (and associated archaeological deposits).

Within the vicinity of Angiola, a semi-ubiquitous middle Holocene paleosol was also identified at just over 1 meter below surface. A much older Pleistocene paleosol was observed in at least one of the trenches (T10) approximately 2.5 meters below surface. These results suggest that the greatest sensitivity for buried archaeological resources in this area is at 1 meter and below, but likely no deeper than 2 to 3 meters. Together with the results from the Corcoran area, and those south of Angiola (summarized below), there seems to be a general trend for high geoarchaeological sensitivity near-surface (±1 meter) with rapidly decreasing sensitivity at depth, in those areas along the Tulare Lake shoreline.

Finally, south of Angiola, at the interface between the historic shoreline of Tulare Lake and the distal fans terminating at the basin, a single distinct well-developed paleosol was observed directly below the plow-zone (at approximately 0.7 meter). Given the high clay content of this soil, it may have been submerged below Tulare Lake at certain times. The presence of historic-era debris at this surface indicates that it was exposed at the surface relatively recently. Although no dates were obtained for this location, the well-developed nature of the soil, and the lack of observable buried stable landforms deeper in the stratigraphic profile, suggest a generally low sensitivity for buried archaeological deposits. This area was anticipated to be of very high sensitivity by the predictive model, but appears to have low to moderate sensitivity.

The accretion of alluvial sediment within the alluvial fan and basin landforms investigated for this study appears to be much less than anticipated. In a synopsis of San Joaquin Valley archaeology, Riddell (2002:56) surmised that the valley, prior to the historic impounding of waterways, received an average accretion of from 1 to 1.5 meters of alluvium each millennium; thus increasing the likelihood of preservation of buried archaeological sites. However, the stratigraphic profiles and dating discussed above indicate that, adjacent to Tulare Lake, middle Holocene soils are buried on the order of only 1 meter below the current ground surface, and Pleistocene soils at 2 to 3 meters—much less than suggested by Riddell. Within the portion of the Kings River fan that was investigated, average deposition rates appear to be approximately twice as much, with middle Holocene soils buried on the order of 2 to 3 meters below surface. Given the size of the Kings River watershed and alluvial fan, compared to the other smaller river systems to the south, this difference is perhaps not surprising. Functionally, these results suggest that buried archaeological sites, if present along the area fronting Tulare Lake, will be on average at shallower depths than other locations further up the Kings River alluvial fan.

Based on the findings of this study, several recommendations can be made for the Fresno to Bakersfield Section of the HST project, moving forward. Although no archaeological resources were encountered during the field investigations, in general, the sensitivity model developed by Meyer et al. (2010) appears to be more-or-less accurate. The exception is the most southern area investigated. For this area, it is recommended that the APE should be considered to have an average of moderate sensitivity moving south, to the areas which are currently mapped as such (Figure 3-4, Appendix A). For the remainder of the APE, the sensitivity model is generally assumed to be accurate. As such, additional measures may be necessary to ensure that the potential for encountering buried archaeological resources during project construction is adequately considered; including additional geoarchaeological testing in areas of highest sensitivity (e.g., near water courses) once access to other portions of the APE is secured, and monitoring in other areas of high sensitivity during construction.

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Chapter 5.0
References

5.0 References

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Appendix A

Revised Geoarchaeological Sensitivity Maps of the APE

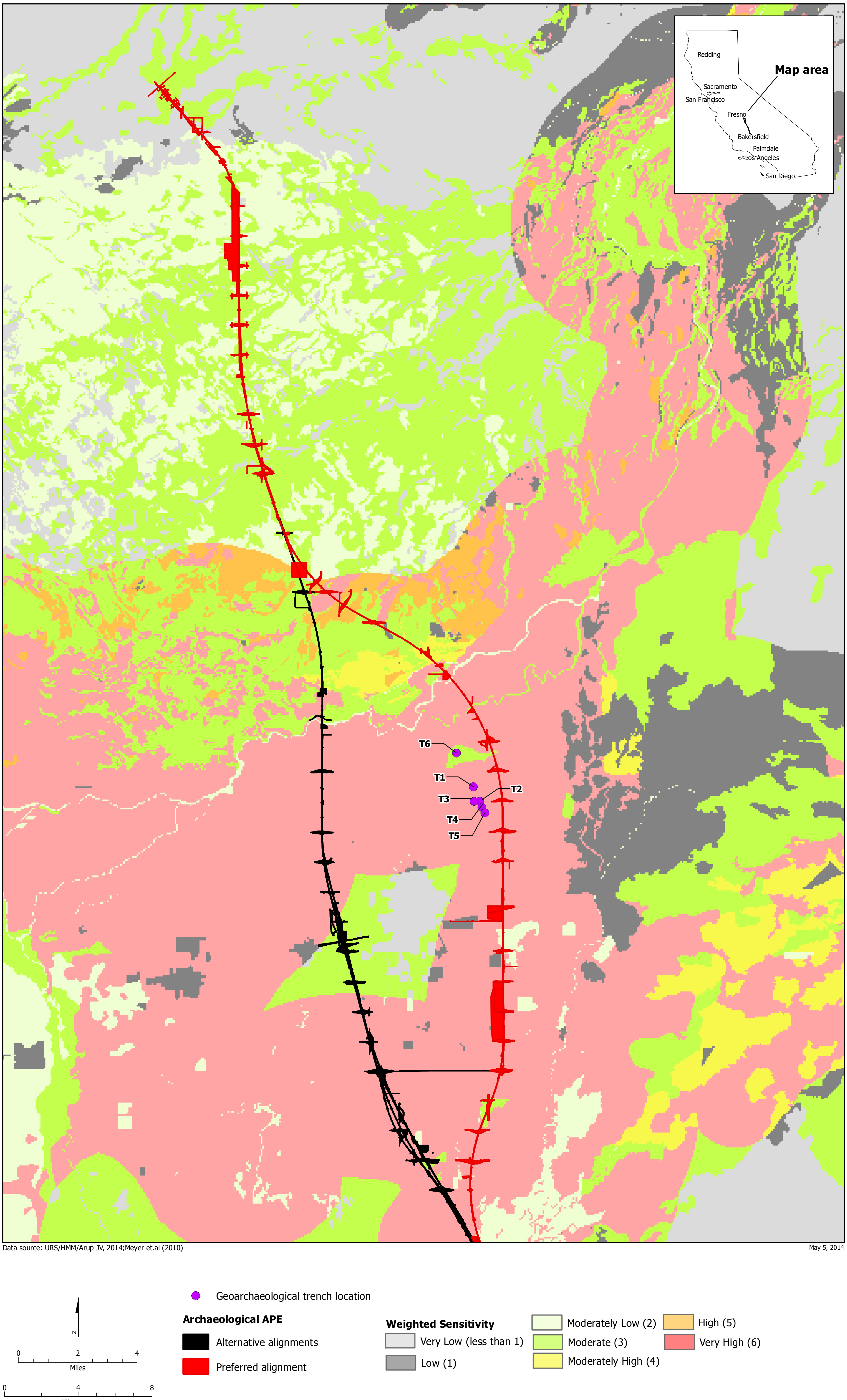
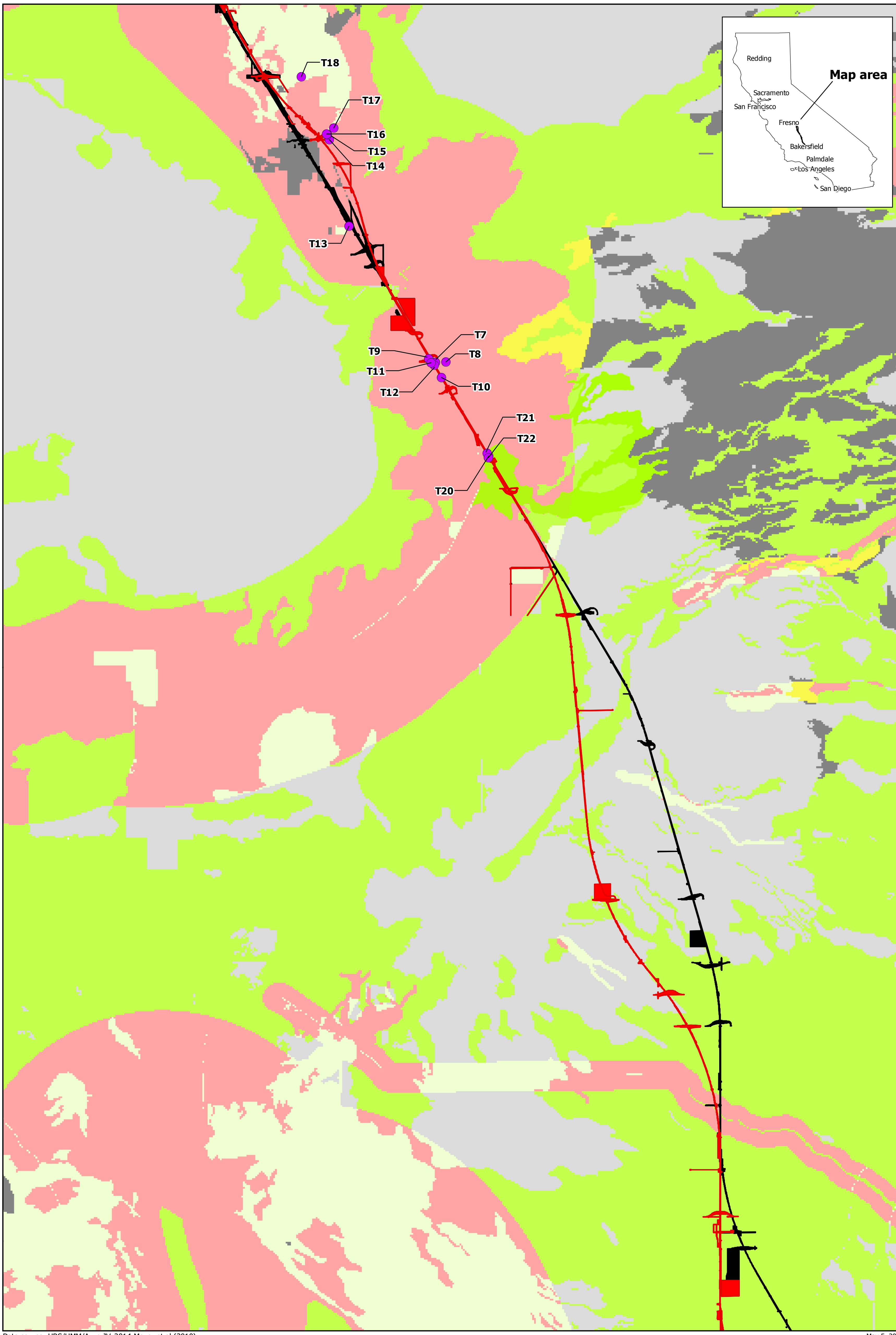


Figure 3-4
Reclassified Weighted sensitivity for buried archaeology
Page 1 of 3



Data source: URS/HMM/Arup JV, 2014;Meyer et.al (2010)

May 5, 2014

N

0 2 4 Miles

0 4 8 Kilometers

Geoarchaeological trench location

Archaeological APE

Alternative alignments

Preferred alignment

Weighted Sensitivity

Very Low (less than 1)

Low (1)

Moderately Low (2)

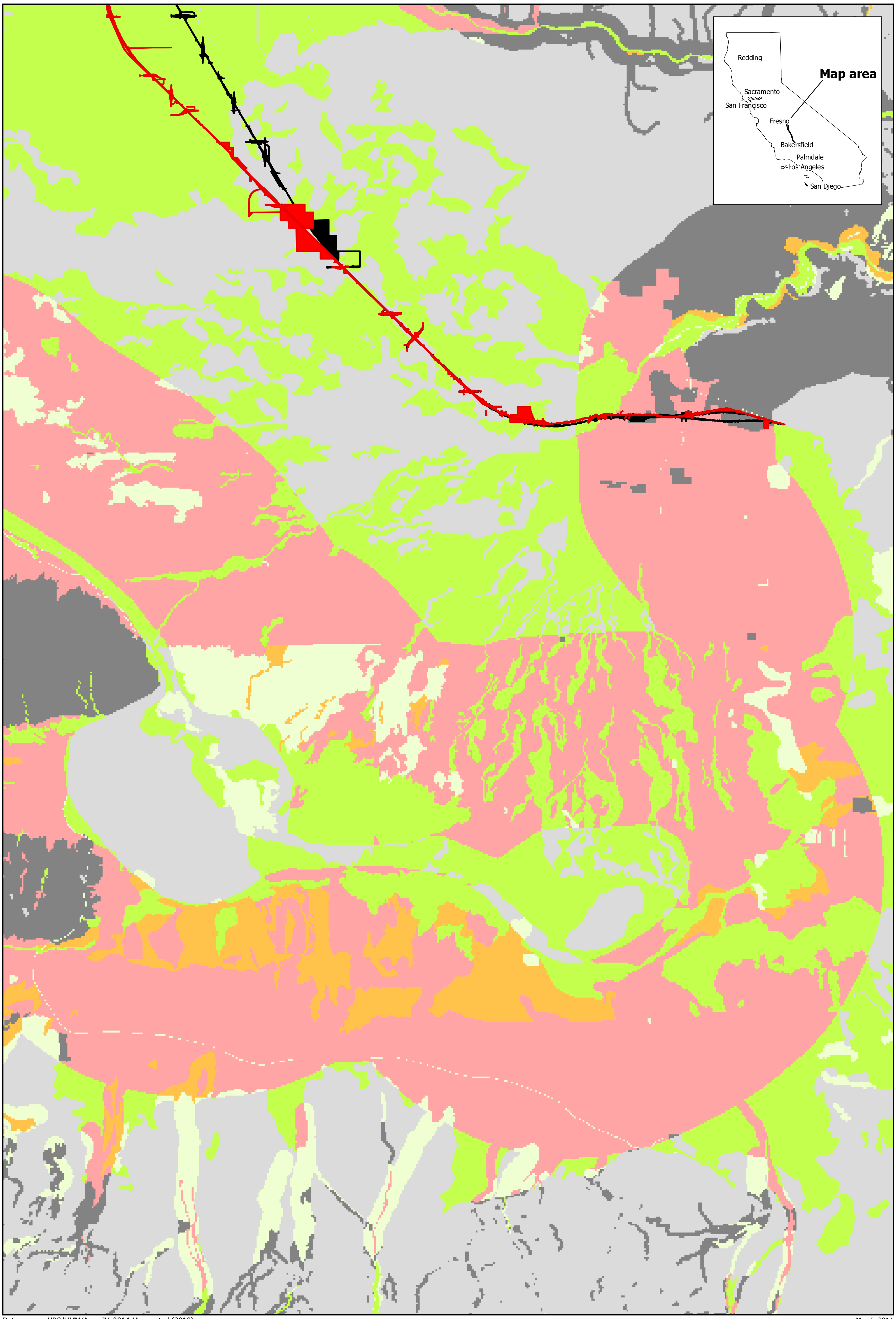
Moderate (3)

Moderately High (4)

High (5)

Very High (6)

Figure 3-4
Reclassified Weighted sensitivity for buried archaeology
Page 2 of 3



Data source: URS/HMM/Arup JV, 2014;Meyer et.al (2010)

May 5, 2014

N

0 2 4
Miles

0 4 8
Kilometers

Geoarchaeological trench location

Archaeological APE

Alternative alignments

Preferred alignment

Weighted Sensitivity

Very Low (less than 1)

Low (1)

Moderately Low (2)

Moderate (3)

Moderately High (4)

High (5)

Very High (6)

Figure 3-4
Reclassified Weighted sensitivity for buried archaeology
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Appendix B
Radiocarbon Lab Results

BETA

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Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

April 17, 2012

Mr. Jay Rehor
URS Corporation
1333 Broadway
Suite 800
Oakland, CA 94612

RE: Radiocarbon Dating Results For Samples T1(220CMBS), T4(290CMBS), T10(240CMBS), T12(100CMBS), T14(290CMBS), T18(170CMBS)

Dear Mr. Rehor:

Enclosed are the radiocarbon dating results for six samples recently sent to us. They each provided plenty of carbon for accurate measurements and all the analyses proceeded normally. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable.

As always, no students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analyses. We analyzed them with the combined attention of our entire professional staff.

If you have specific questions about the analyses, please contact us. We are always available to answer your questions.

The cost of analysis was previously invoiced. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood
Digital signature on file

BETA ANALYTIC INC.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Jay Rehor — Report Date: 4/17/2012

URS Corporation — Material Received: 4/2/2012

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 319531	5710 +/- 30 BP	-21.3 o/oo	5770 +/- 30 BP

SAMPLE : T1(220CMBS)
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal BC 4710 to 4540 (Cal BP 6660 to 6490)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 319532	5480 +/- 40 BP	-23.7 o/oo	5500 +/- 40 BP

SAMPLE : T4(290CMBS)
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal BC 4440 to 4420 (Cal BP 6400 to 6370) AND Cal BC 4400 to 4380 (Cal BP 6350 to 6330) Cal BC 4370 to 4320 (Cal BP 6320 to 6270) AND Cal BC 4290 to 4270 (Cal BP 6240 to 6220)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 319533	15020 +/- 60 BP	-23.2 o/oo	15050 +/- 60 BP

SAMPLE : T10(240CMBS)
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal BC 16590 to 16480 (Cal BP 18540 to 18430) AND Cal BC 16400 to 16100 (Cal BP 18350 to 18050)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 319534	5960 +/- 40 BP	-22.3 o/oo	6000 +/- 40 BP

SAMPLE : T12(100CMBS)
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal BC 5000 to 4790 (Cal BP 6940 to 6740)

RFP No.: HSR 14-32 - INITIAL RELEASE - 05/27/2015

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

BETA ANALYTIC INC.
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beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Jay Rehor

Report Date: 4/17/2012

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 319535	10700 +/- 50 BP	-22.4 o/oo	10740 +/- 50 BP

SAMPLE : T14(290CMBS)
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal BC 10730 to 10640 (Cal BP 12680 to 12580)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 319536	8940 +/- 40 BP	-22.6 o/oo	8980 +/- 40 BP

SAMPLE : T18(170CMBS)
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal BC 8280 to 8200 (Cal BP 10230 to 10150) AND Cal BC 8110 to 8090 (Cal BP 10060 to 10040) Cal BC 8040 to 8010 (Cal BP 9990 to 9960)

RFP No.: HSR 14-32 - INITIAL RELEASE - 05/27/2015

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-21.3:lab. mult=1)

Laboratory number: **Beta-319531**

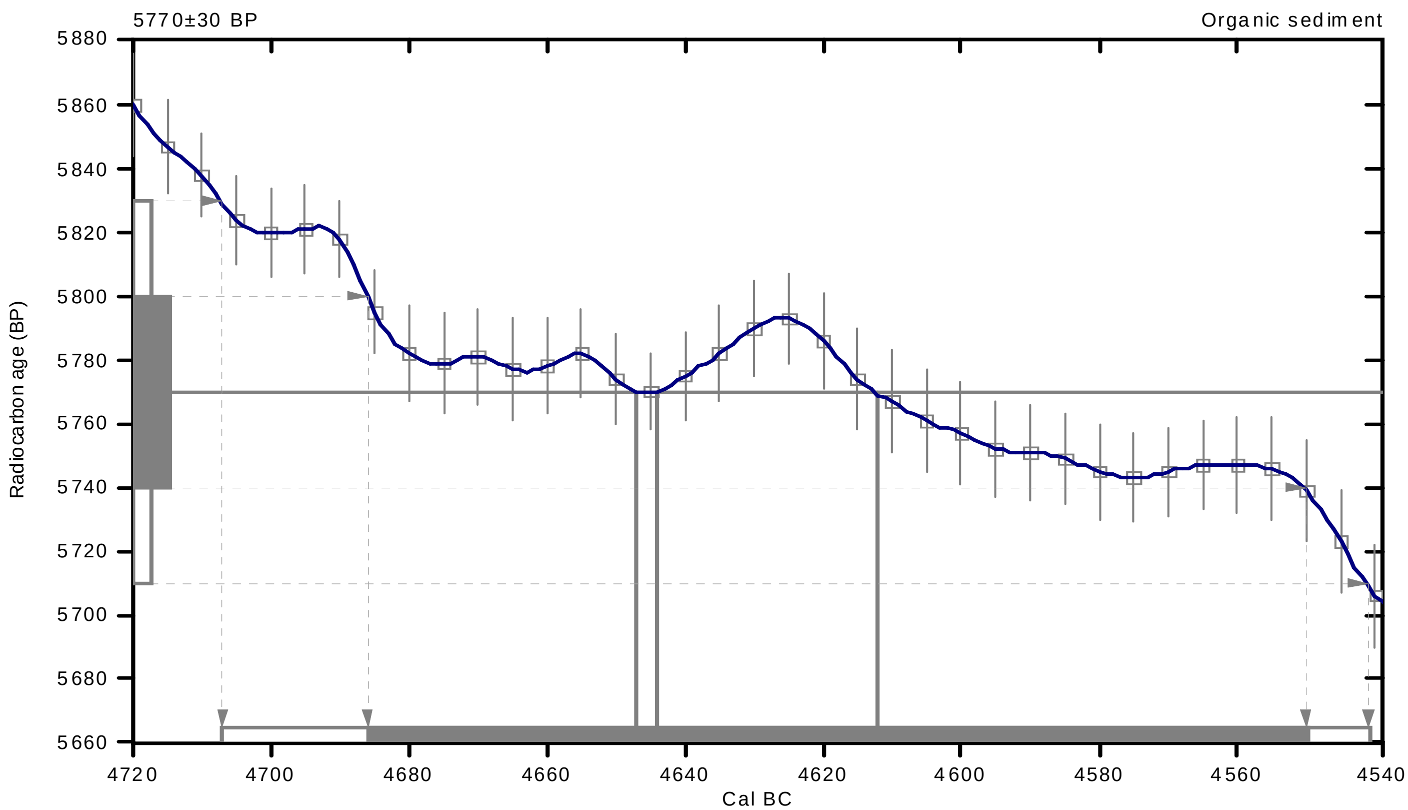
Conventional radiocarbon age: **5770±30 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 4710 to 4540 (Cal BP 6660 to 6490)**

Intercept data

Intercepts of radiocarbon age with calibration curve: Cal BC 4650 (Cal BP 6600) and
Cal BC 4640 (Cal BP 6590) and
Cal BC 4610 (Cal BP 6560)

1 Sigma calibrated result: (68% probability) Cal BC 4690 to 4550 (Cal BP 6640 to 6500)



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-23.7:lab. mult=1)

Laboratory number:	**Beta-319532**
Conventional radiocarbon age:	**5500±40 BP**
2 Sigma calibrated results: (95% probability)	**Cal BC 4440 to 4420 (Cal BP 6400 to 6370) and Cal BC 4400 to 4380 (Cal BP 6350 to 6330) and Cal BC 4370 to 4320 (Cal BP 6320 to 6270) and Cal BC 4290 to 4270 (Cal BP 6240 to 6220)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal BC 4340 (Cal BP 6290)
1 Sigma calibrated result: (68% probability)	Cal BC 4360 to 4330 (Cal BP 6310 to 6280)

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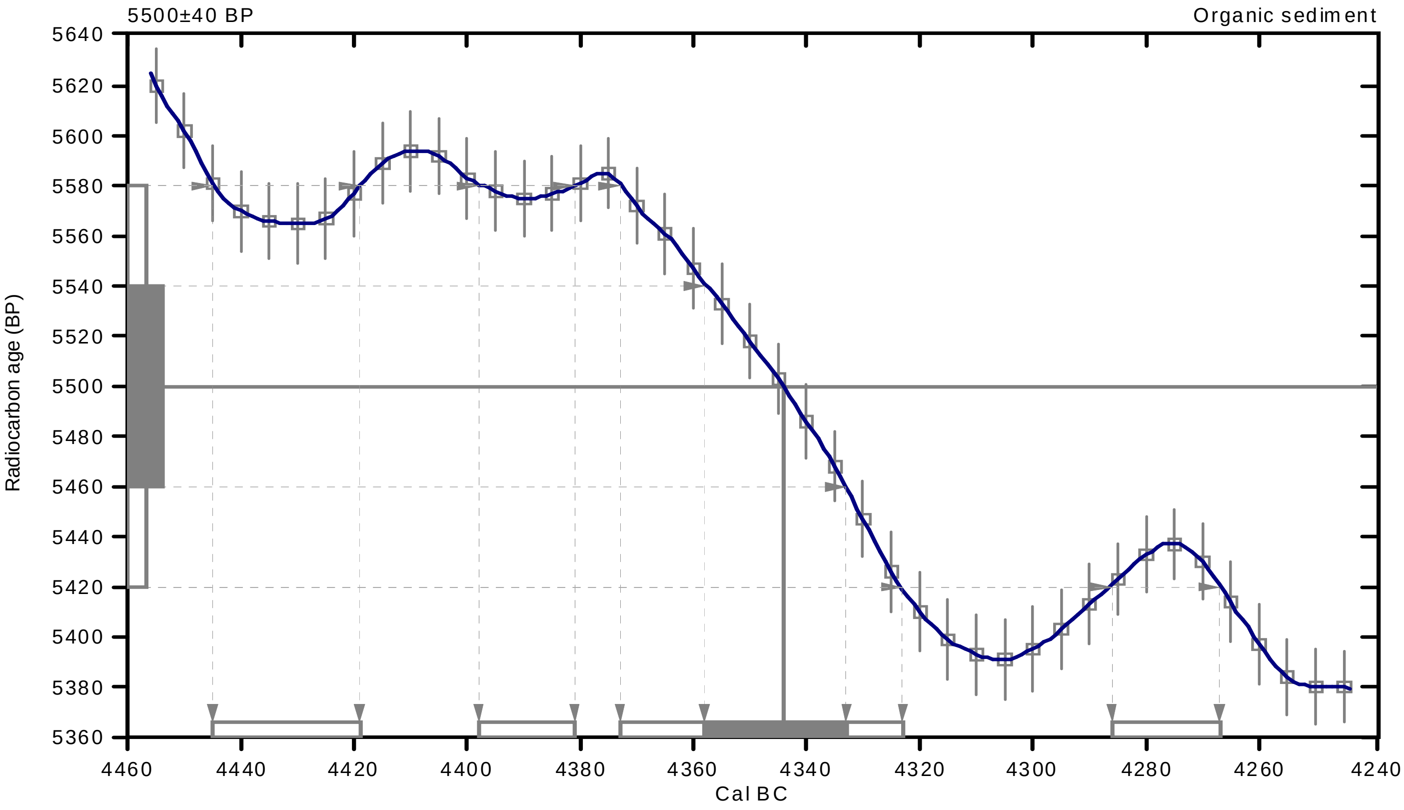

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-23.2:lab. mult=1)

Laboratory number: **Beta-319533**

Conventional radiocarbon age: **15050±60 BP**

2 Sigma calibrated results: (95% probability) **Cal BC 16590 to 16480 (Cal BP 18540 to 18430) and Cal BC 16400 to 16100 (Cal BP 18350 to 18050)**

Intercept data

Intercepts of radiocarbon age with calibration curve: Cal BC 16540 (Cal BP 18490) and
Cal BC 16300 (Cal BP 18250) and
Cal BC 16210 (Cal BP 18160)

1 Sigma calibrated results: (68% probability) Cal BC 16570 to 16520 (Cal BP 18520 to 18470) and
Cal BC 16350 to 16140 (Cal BP 18300 to 18090)

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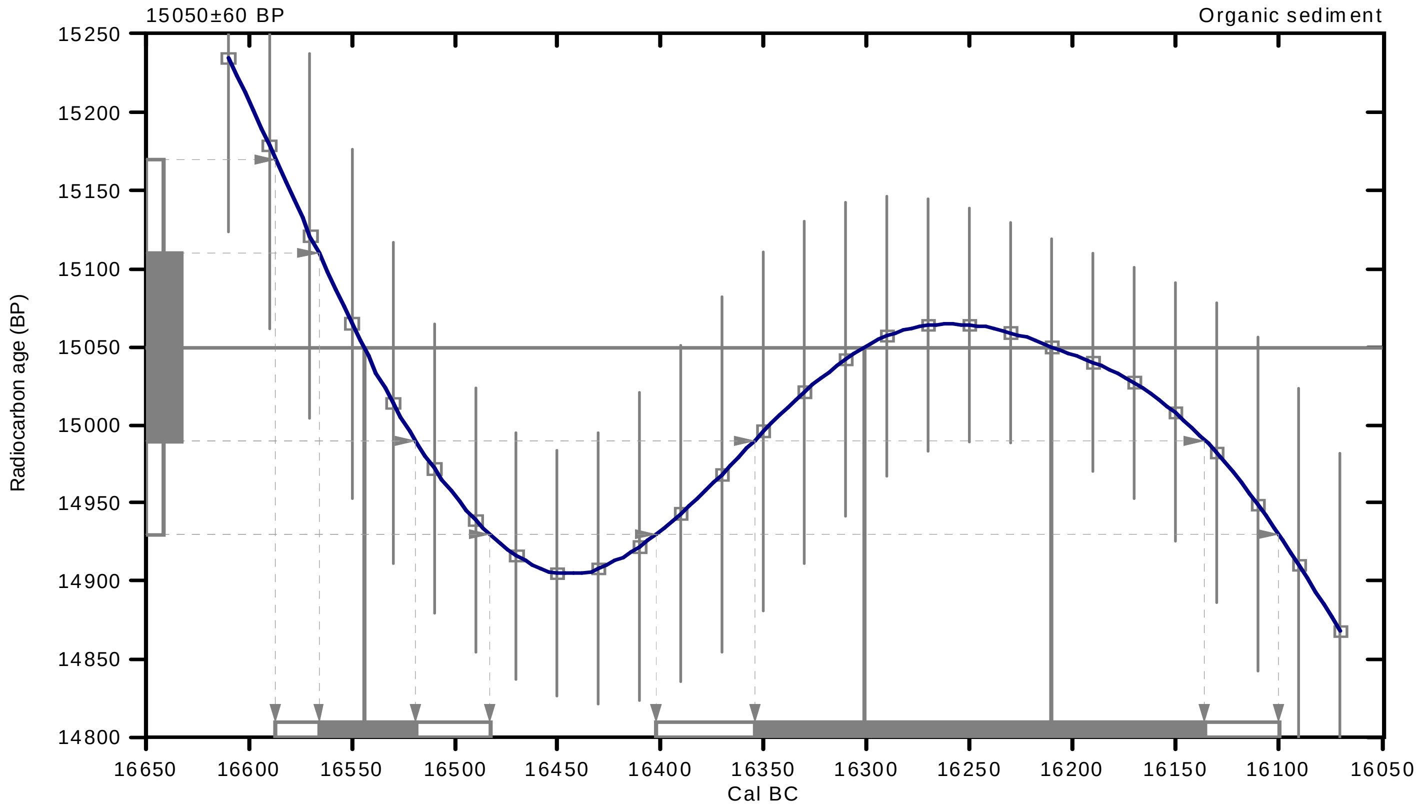

References:

Database used

INTCAL09

References to INTCAL09 database

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-22.3:lab. mult=1)

Laboratory number: **Beta-319534**

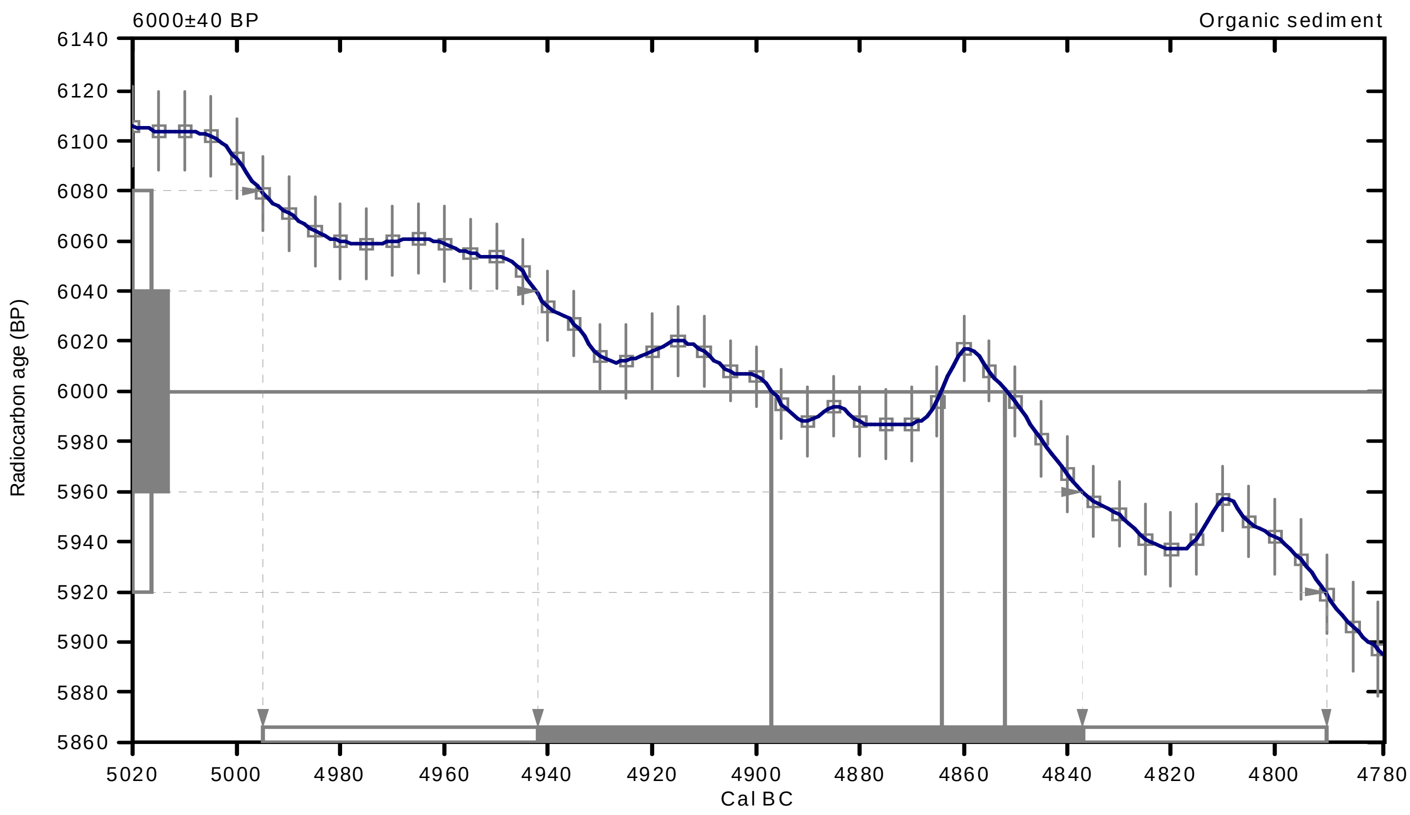
Conventional radiocarbon age: **6000±40 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 5000 to 4790 (Cal BP 6940 to 6740)**

Intercept data

Intercepts of radiocarbon age with calibration curve: Cal BC 4900 (Cal BP 6850) and
Cal BC 4860 (Cal BP 6810) and
Cal BC 4850 (Cal BP 6800)

1 Sigma calibrated result: (68% probability) Cal BC 4940 to 4840 (Cal BP 6890 to 6790)



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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-22.4:lab. mult=1)

Laboratory number: **Beta-319535**

Conventional radiocarbon age: **10740±50 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 10730 to 10640 (Cal BP 12680 to 12580)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 10680 (Cal BP 12630)

1 Sigma calibrated result: (68% probability) Cal BC 10700 to 10660 (Cal BP 12650 to 12600)

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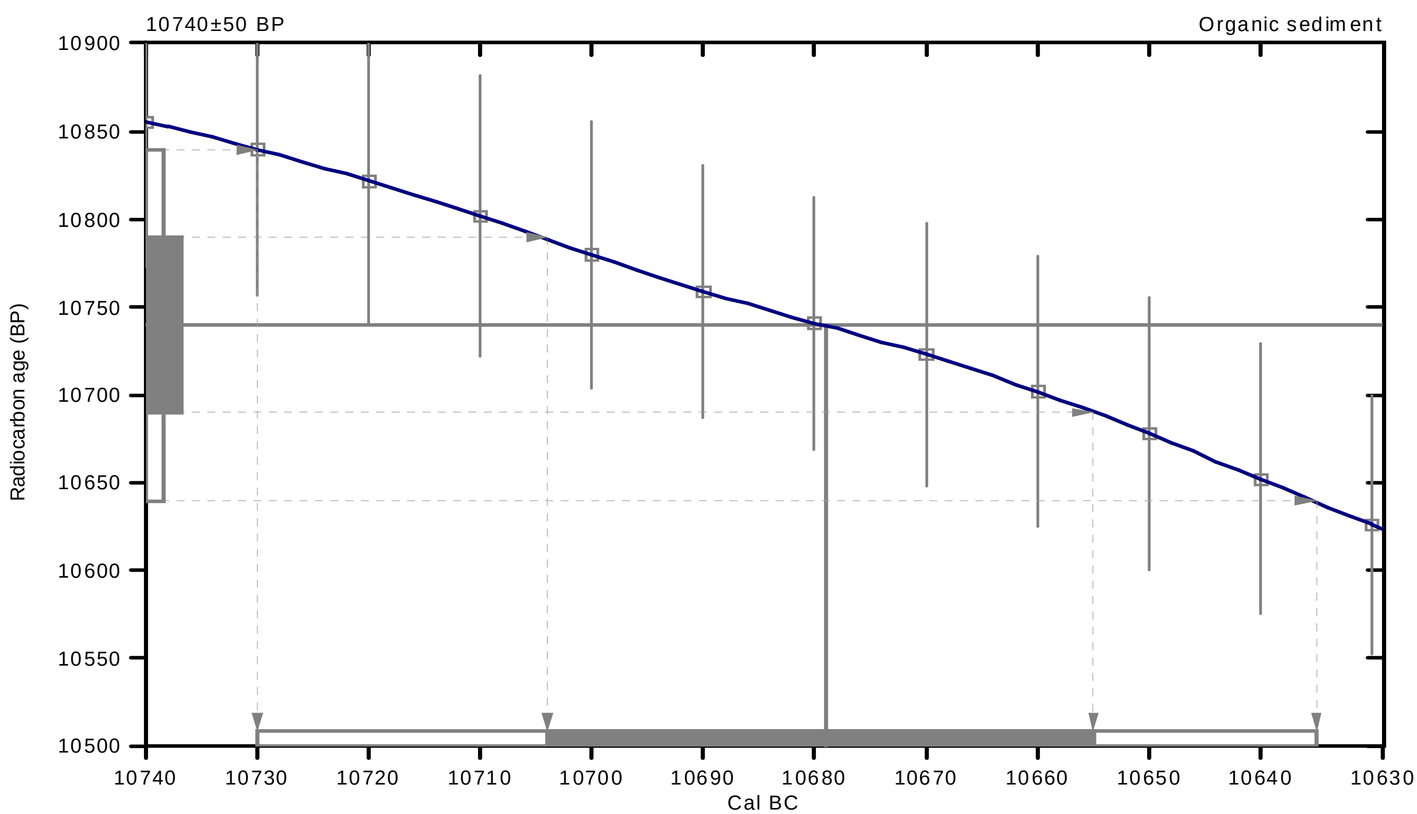

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Mathematics used for calibration scenario

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-22.6:lab. mult=1)

Laboratory number: **Beta-319536**

Conventional radiocarbon age: **8980±40 BP**

2 Sigma calibrated results: **Cal BC 8280 to 8200 (Cal BP 10230 to 10150) and**
(95% probability) **Cal BC 8110 to 8090 (Cal BP 10060 to 10040) and**
Cal BC 8040 to 8010 (Cal BP 9990 to 9960)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal BC 8240 (Cal BP 10190)

1 Sigma calibrated result: Cal BC 8260 to 8220 (Cal BP 10200 to 10170)
(68% probability)

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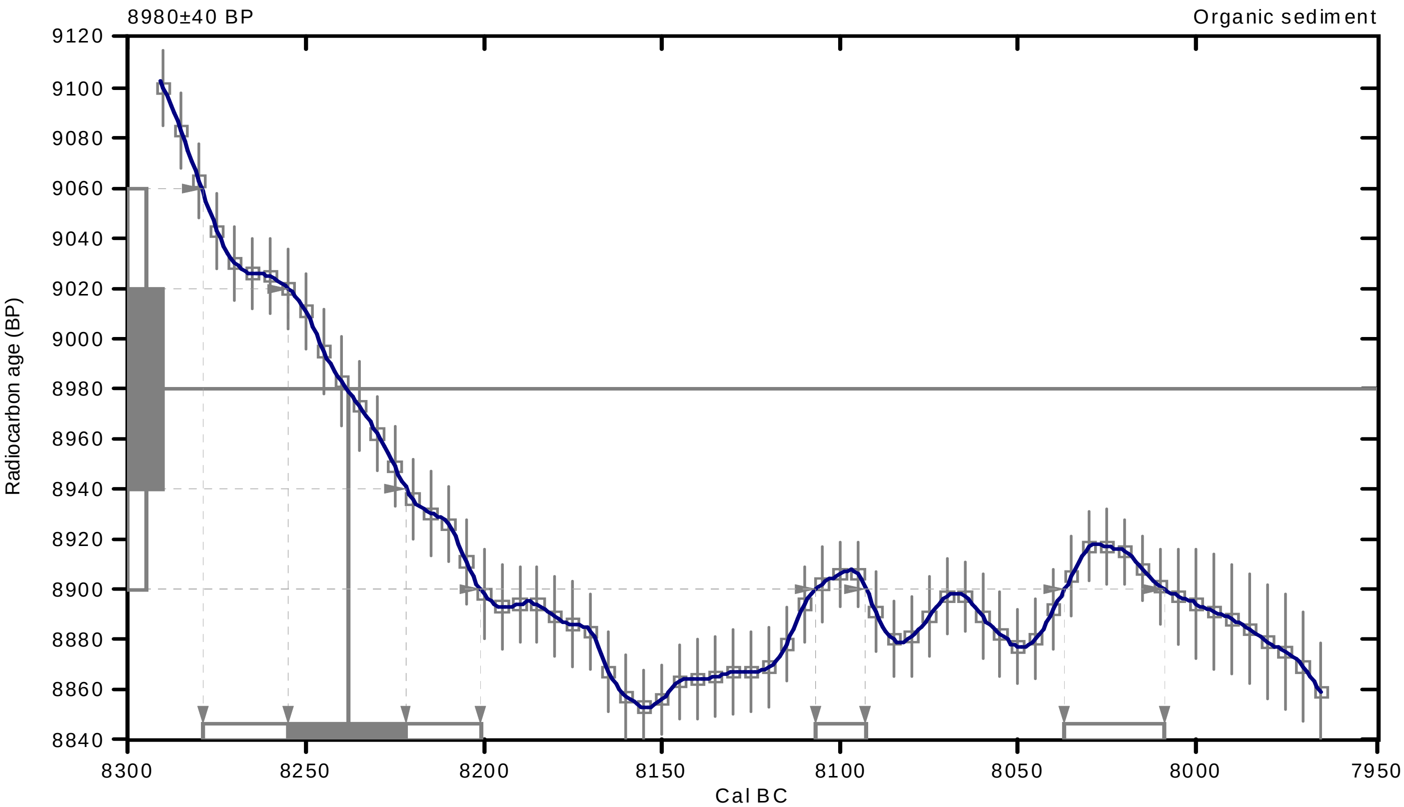

References:

Database used
INTCAL09

References to INTCAL09 database
Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

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